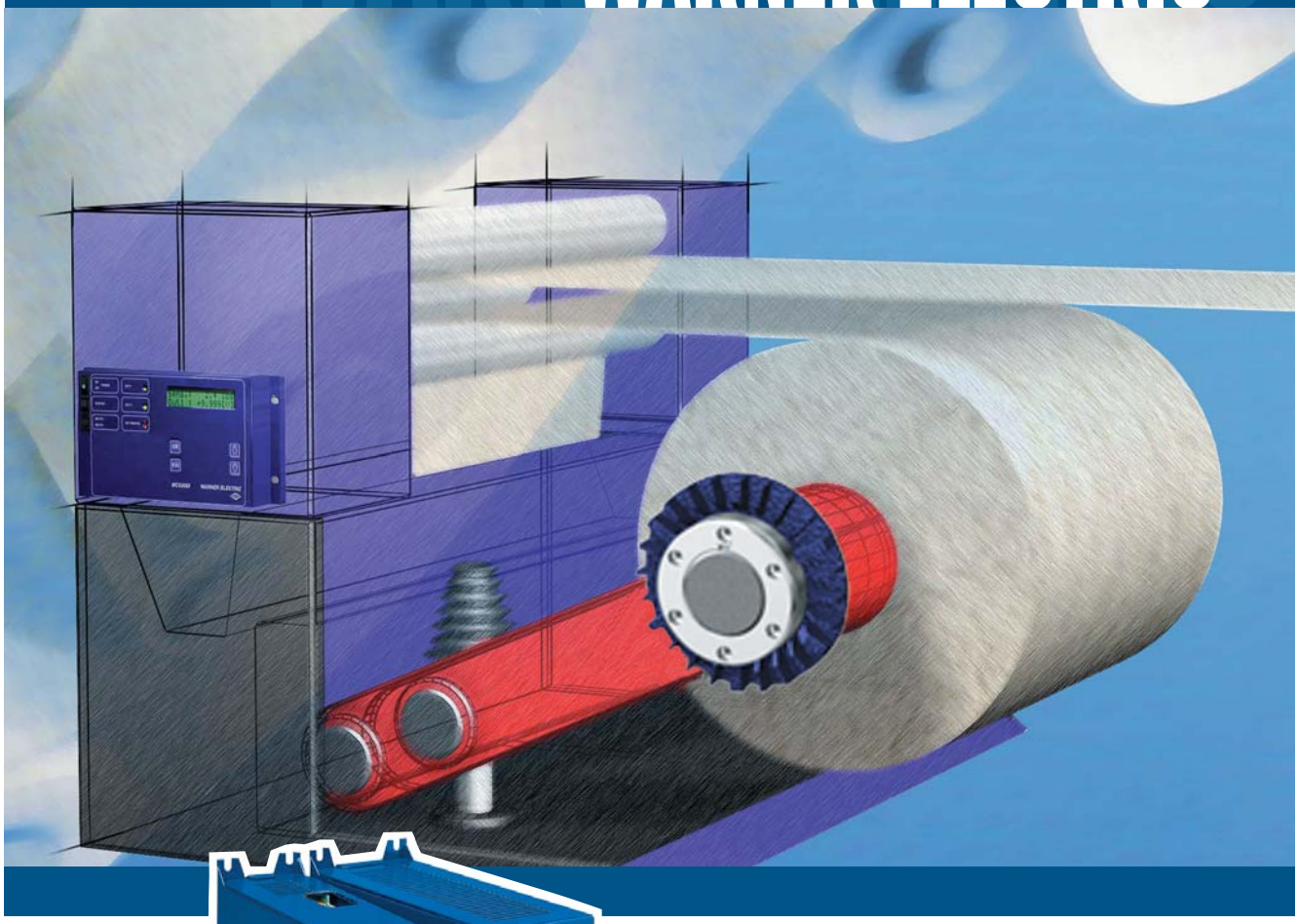
WARNER ELECTRIC



Tension Control Systems

Max Lamb GmbH & Co. KG
Am Bauhof
97076 Würzburg
Tel. 0931 / 2794 – 0
Fax. 0931 / 274557
email: ant@lamb.de

Warner Electric

Tension Control Systems

WARNER ELECTRIC offers the most complete product line dedicated to the TENSION CONTROL MARKET. The long experience in the market led us to develop high performance controls able to operate in open and closed loop with brakes. **WARNER ELECTRIC** electromagnetic brakes find an optimum use in tension control when associated with the new digital control line.

ABOUT THIS CATALOGUE

This master catalogue groups all the solutions / products that WARNER ELECTRIC offers. An important part is dedicated to the solution design with particular consideration regarding the machine and the tension control installed. This should help you for the right solution choice taking in consideration the results you want to achieve. All the product characteristics and dimensions are included for every product.

Applying the appropriated Tension Control will lead you

- To improve quality of the operation
- To increase the production
- Finally to lower your production cost

CONTACT WARNER ELECTRIC FOR ANY ASSISTANCE YOU REQUIRE

www.warnerelectric-eu.com

Index

		Pages
SYSTEM CONFIGURATIONS		**4**
	System configuration 1	4
	System configuration 2	4
	System configuration 3	5
	Open loop solutions	6
	Closed loop solutions	7
TENSION CONTROL IN OPEN LOOP		**8**
I.a	- Manual setting by pot.	8 - 9
I.b	- Manual setting by following arm	8 - 9
II	- Automatic setting by diameter reading	10-11
III	- Automatic setting by diameter reading with additional functions	12-13
TENSION CONTROL IN CLOSED LOOP		**14**
I	- Single roll tension control, automatic setting by dancer arm	14 - 17
II	- Double roll tension control, automatic setting by dancer arm (modular)	18-19
III	- Double roll or splicer tension control, automatic setting by dancer arm (compact)	20-21
IV	- Double roll or splicer tension control, automatic setting by load cells	22-25
BRAKES AND CLUTCHES RANGE		**26**
	Brakes and clutches models	26
ELECTROMAGNETIC BRAKE TYPE TB		**28**
	Tension brake sizing	27
	TB brake characteristics	28 - 31
	Tension brake for strapping machine	32 -33
MAGNETIC PARTICLE CLUTCHES AND BRAKES		**34**
	Design and operation	34 - 35
	Selection	36 - 37
	Applications	38 - 39
	Dimensions and specifications	40 - 41
	Current regulator power supply for powder brakes	42
MAGNETIC CLUTCHES AND BRAKES		**43**
	Design and operation	43
	Applications	44
	Dimensions and specifications	45 - 50
DATA APPLICATION FORM		**51**
	Material tension data	51
	Calculation dates form	52 - 53

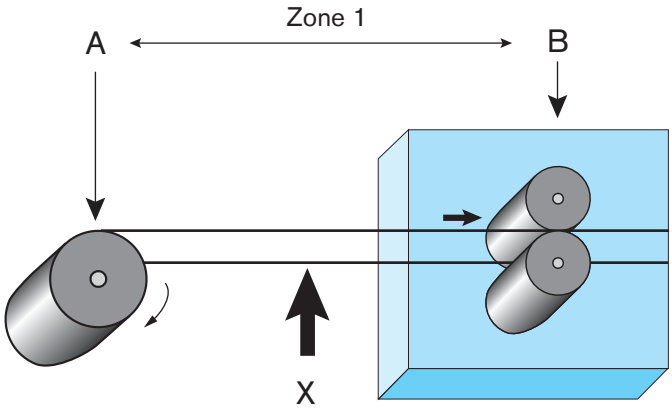
System configurations

Analysing and preparing a project in tension control requires good analysis support. The general block diagrams below are a good representation of any machine generally supporting tension control. We recommend using these diagrams or a part of it in any discussion and correspondence in order to be clear and to avoid possible misunderstandings.

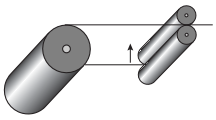
The tension area in an unwinding system is defined by places where we want to control this tension

SYSTEM CONFIGURATION 1

In single roll unwinding, we have one area tension between A and B. One brake can be easy installed in A. The brake control system selected will be according to the accuracy required: open loop or close loop.



ZONE 1*, Typical characteristics (unwind)

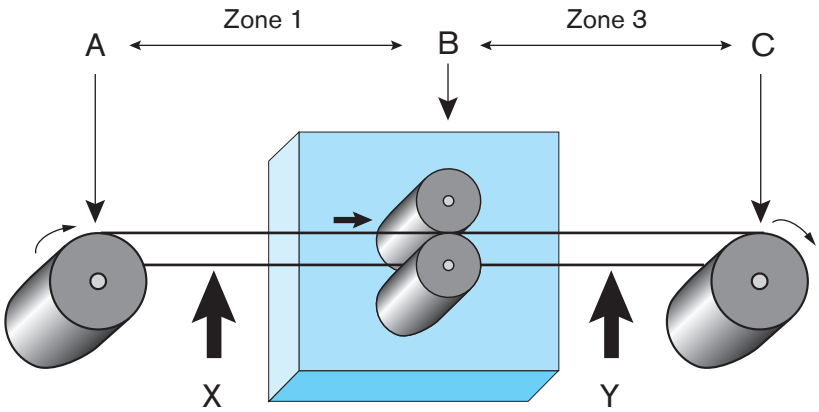


- ❒ Tension zone definition: A-B
- ❒ Speed point in B
- ❒ Variable roll rotation speed
- ❒ Variable inertia
- ❒ In general constant tension X
- ❒ Brake system applicable

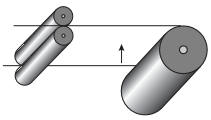
SYSTEM CONFIGURATION 2

Most usual configuration with driving roll,a rewinder and an unwinder.2 separate tension area with tension could be different in X and in Y.Regarding accuracy required we will choice open loop or close loop.

In A, unwinding brake, in B motor for the speed and in C clutch or moto-reducer for rewinding.



Zone 3*, Typical characteristics (rewind)

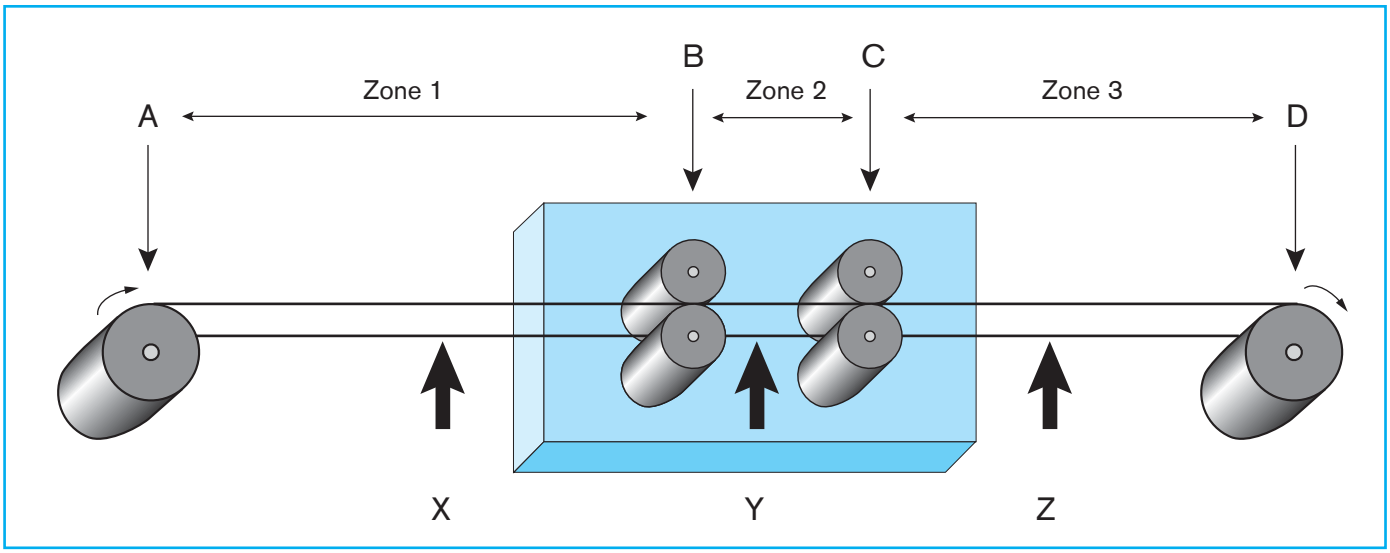


- ❒ Tension zone definition B-C
- ❒ Speed point in B
- ❒ Variable roll rotation speed
- ❒ Variable inertia
- ❒ Constant or Taper tension Z
- ❒ Particle brake system applicable

SYSTEM CONFIGURATION 3

More complicated machine with intermediary tension area between winder and unwinder.The intermediary area give the line speed. A master-slave system with speed difference in area B/C give required tension.

All tension systems must be according the speed line in close loop.

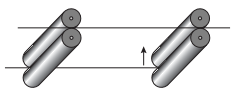


IMPORTANT CONSIDERATION

In every machine the speed point location must be clearly identified. In general one of driving nip roll is choose to set the linear speed. The machine speed is considered as **MASTER** function. The tension control, whatever the selected solution, works in **SLAVE** mode. Practically, the operator sets the machine speed with a simple potentiometer and all tension control system existing on the machine have to follow, keeping the required tension at any speed and during all transitory speed phases.

***NOTE :** Each zone is individually controlled. Tension may be different in each zone. It is assumed that there is no slipping on the nip roll.

ZONE 2*, Typical characteristics



- ❒ Tension zone definition B-C
- ❒ Speed point in B or C
- ❒ Constant roll rotation speed
- ❒ Constant inertia
- ❒ In general constant tension Y
- ❒ Brake system applicable

System configurations

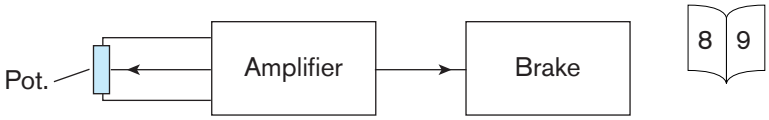
OPEN LOOP CONFIGURATION

Working in open loop requires an external reference setting applied to the driver. The torque applied to the unwind roll has to vary according to the diameter of the roll. We don't control acceleration, deceleration and emergency stop as the sensor is blind regarding the band tension.

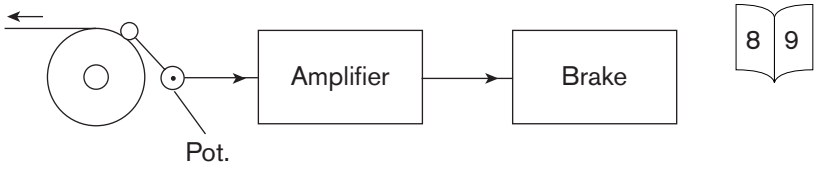
Application needs one sensor only which drives an amplifier without return information for the influence of correction.

OPEN LOOP SOLUTION

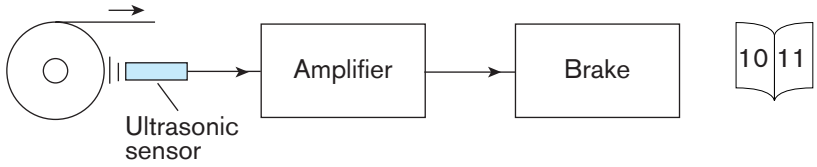
Manual setting by pot.



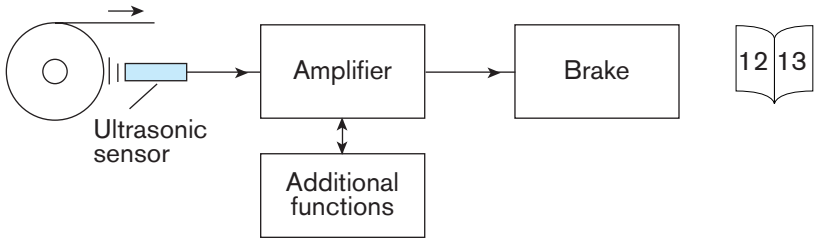
Manual setting by following arm



Automatic setting by diameter reading



Automatic setting by diameter reading with additional functions

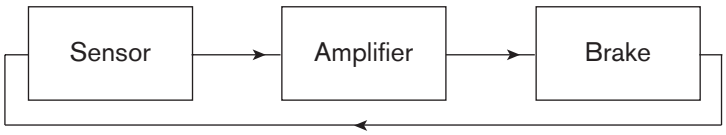


System configurations

CLOSED LOOP CONFIGURATION

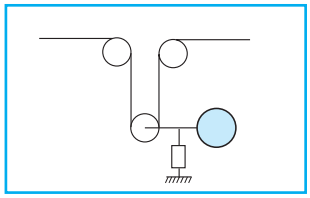
Working in close loop needs one sensor. This one will measure directly or indirectly the band tension. Tension variations detected by sensor are sent to the brake through the control. This action corrects the variation and the new corrected sensor value is sent to the brake and so on.

Give a accurate tension regulation during acceleration, deceleration, emergency stop.



Position regulation by dancer arm

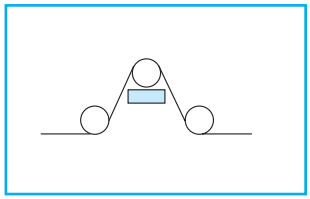
This is an electromechanical system and the building quality for the dancer arm must be verified. The band tension is created by the roll weight and/or by pneumatic actuator which have sensible air exhaust.



14 21

Regulation by load cell

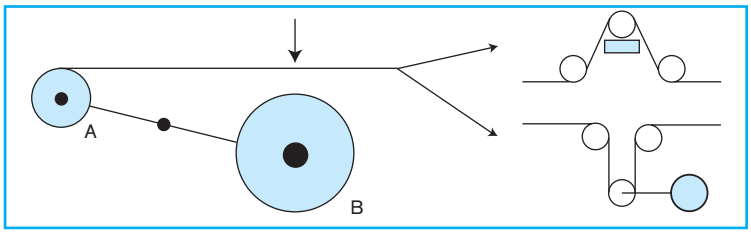
This is an electromechanical system and the quality of load cells mounting must be checked. The band influences directly the load cells or loads cells. The load cells choice and the mounting are very important regarding overload during starting or emergency stop.



22 23

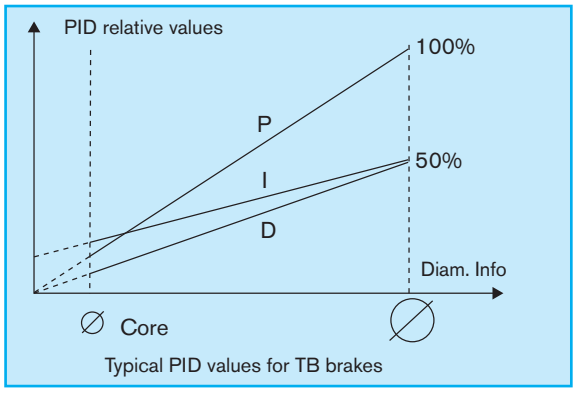
Splicer system regulation

Our control systems are used with double roll unwinders with splicer. The 2 brakes are always controlled, when one is in regulation, the other has holding function through numeric control range MCS2000. These controls include loop control with PID, a lot of options and are able to be programmed by PC (via RS232 line) or by external programmer pocket (visual function)



22 23

The PID function is optimised for one inertia value. The MCS2000 line is inclusive of an important feature namely the PID correction. Based on the available diameter information you can apply a continuous PID correction. When no information is available, an internal PID change can be programmed.



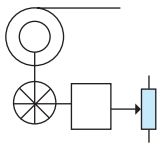
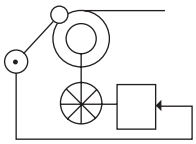
Each parameter P, I and D can be set individually for the smallest (core) and biggest diameter. As soon as the correct parameters are found for the extreme diameter value, they are stored. The diameter information provided will fix the PID values for the present diameter value. This will allow the system to keep an excellent stability during the whole diameter evolution. In the case where the diameter information is not available we can provide this signal by installing a sonic sensor or by working with internal correction. The external diameter information supplied to the controller will ensure a better precision compensation compared to an internal correction.

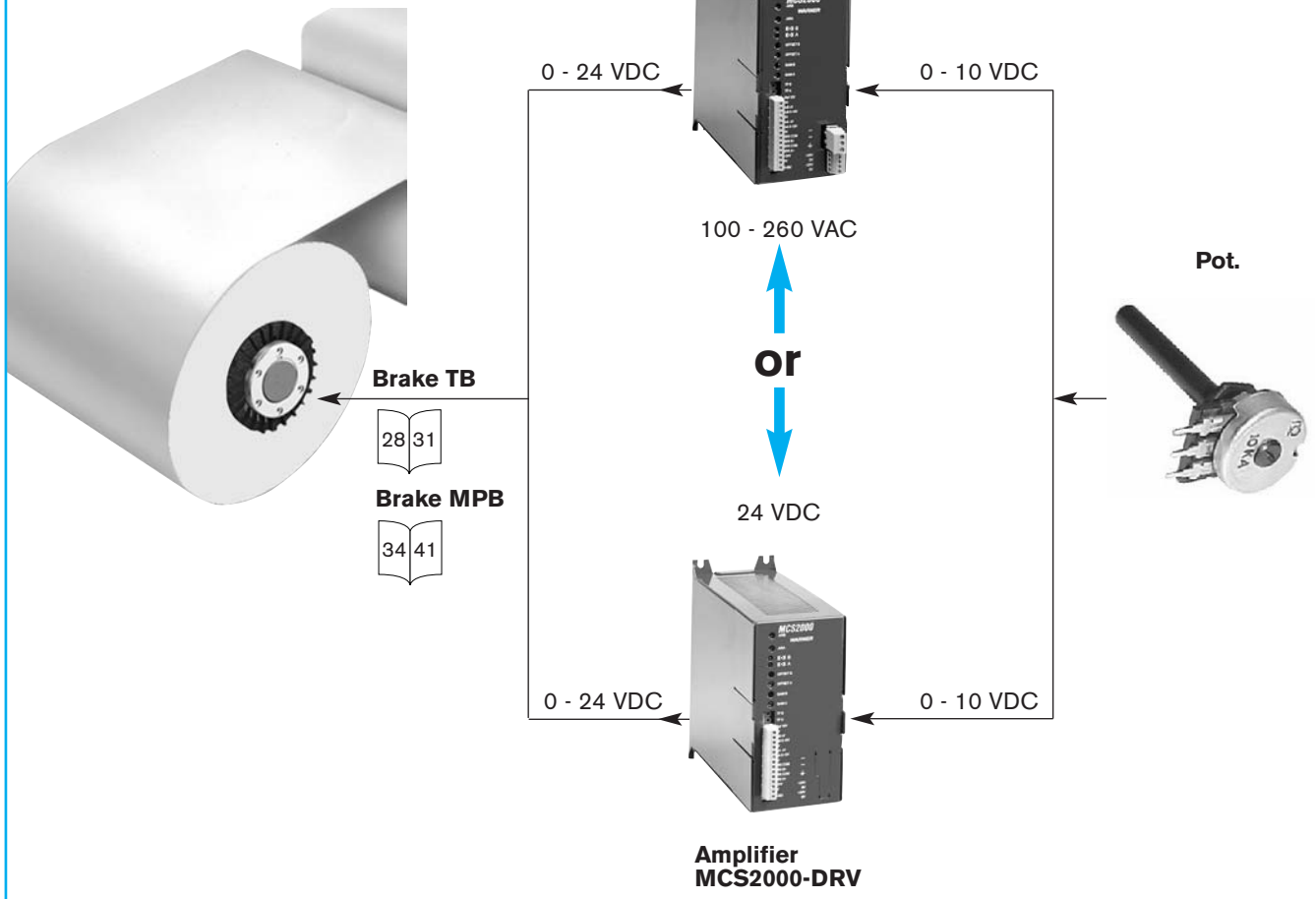
I - Tension control in open loop

Working in open loop requires that a torque setting is defined. The choice depends on the machine complexity and the automation required. One important factor that remains is the tension precision. For unwind and rewind systems the diameter ratio will play an important role. Working in open loop also requires special considerations regarding system inertia.

a Manual setting by pot.
b Manual setting by following arm

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
By Pot.  **Diameter reading** 	❒ Cable machine ❒ No fast accel/deccel ❒ Low roll diameter ratio ❒ Operator intervention admitted	❒ Low cost solution ❒ Easy to start-up ❒ Automatic regulation by diameter following arm ❒ Manual correction feasible	❒ Tension precision depends on operation ❒ For diameter following arm, accuracy according the roll geometry

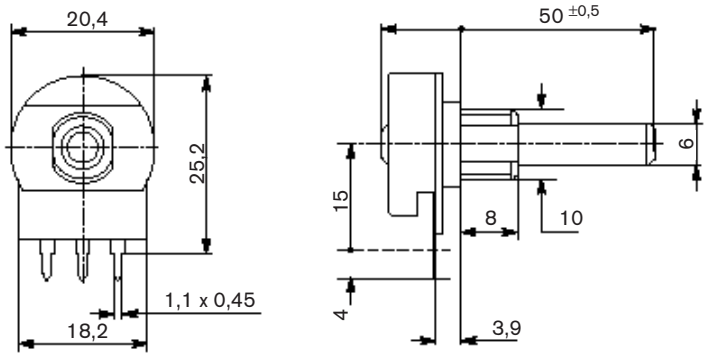


Manual setting by Pot.

Pot.

Resistance value	10 k Ω
Type	Linear
Power rating at 40°C	0,4 W
Tolerance	+ 20%
Electric rotation	280° +20°
Mechanic rotation	300° ±5 %
Operating temperature	-25°C to +70°C
Shaft	ø6 mm
Panel mounting hole	10 mm
Part number	B90-26325C

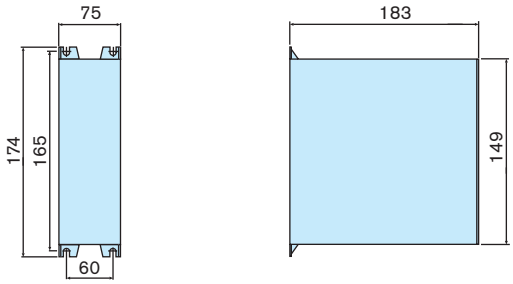
Dimensions (mm)



ELECTRICAL AMPLIFIER MCS2000-PSDRV

❒ 1 alternative/continue current supply card
❒ 1 logic card with 2 individual channels
(1 fixed, 1 with calibration)

Dimensions (mm)



Model	Electrical input signal	Power supply / current	Output voltage / current
MCS2000-PSDRV	0 – 10 VDC	100 – 260 VAC	0-24 VDC/1,4 A
Wiring	Shielded cable		
Setting	Anti-residual		
Mounting position	Vibrations free, vertically		
Service manual	MC517		

ELECTRICAL AMPLIFIER MCS2000

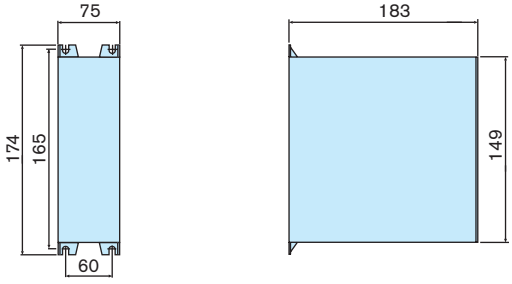
Dimensions (mm)

MCS2000-DRV

❒ 1 logic card with 2 individual channels
(1 fixed, 1 with calibration)

MCS2000-DRV8

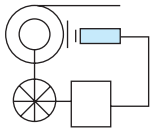
❒ 1 logic card with 8 individual output channels

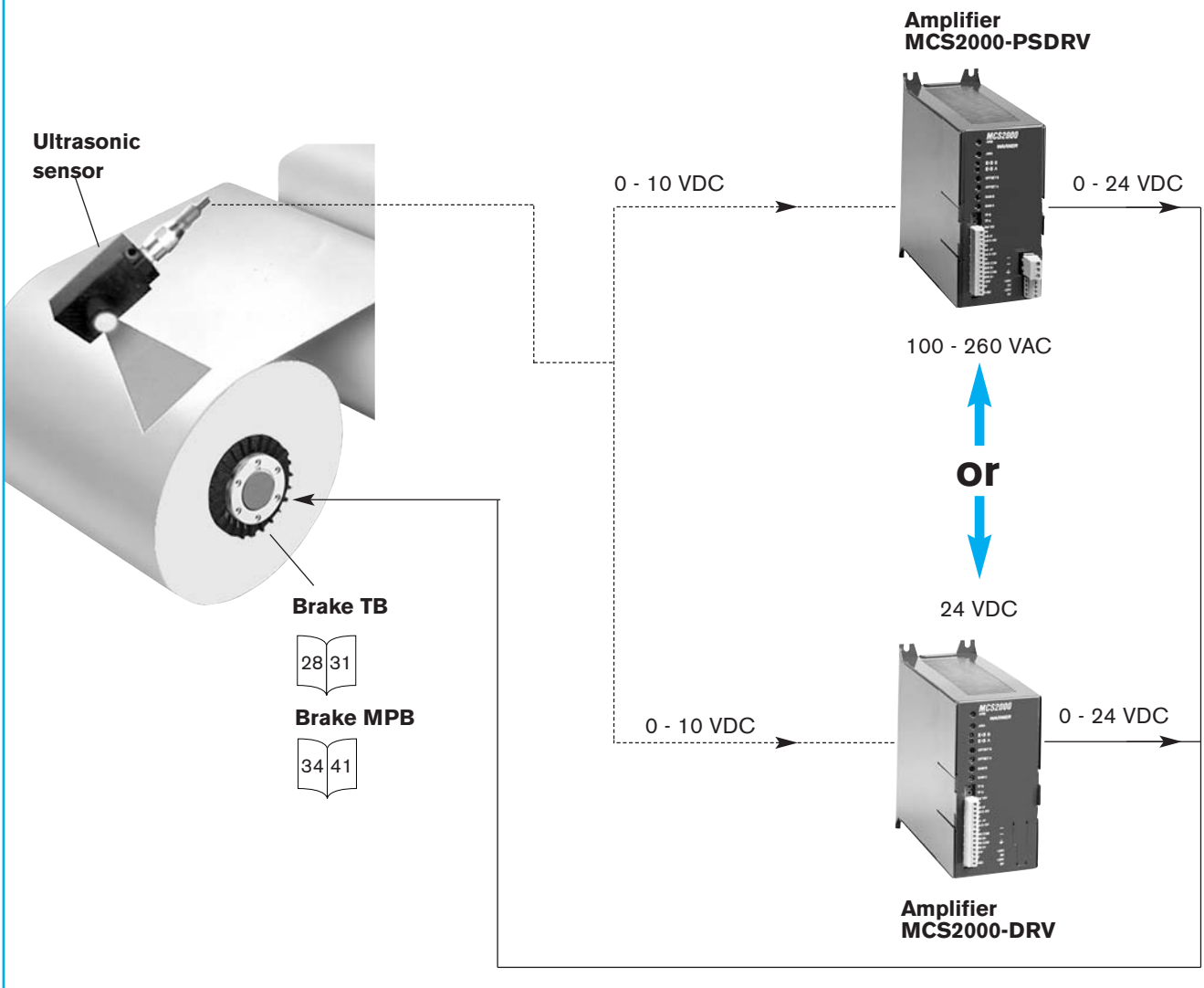


Model	Electrical input signal	Power supply / current	Output voltage / current
MCS2000-DRV	0 – 10 VDC	24 VDC/3 A	0-24 VDC/1,4 A
MCS2000-DRV8	0 – 10 VDC	24 VDC/3 A	0-24 VDC/0,3 A per channel
Wiring	Shielded cable		
Setting	Anti-residual		
Mounting position	Vibrations free, vertically		
Service manual	MC517		

II - Tension control in open loop

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Diameter reading 	❒ The most commonly used solution in open loop ❒ No operator intervention admitted ❒ Large roll ø ratio	❒ Physical reading, no reset ❒ Easy to start-up	❒ Poor reading accuracy on core



Automatic setting by diameter reading

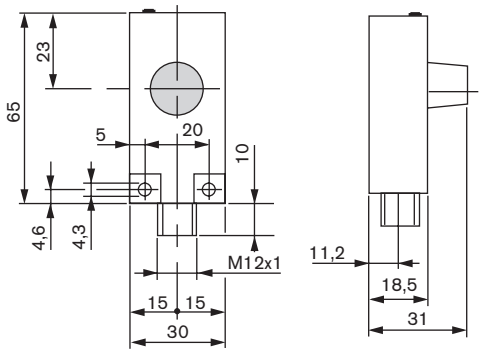
ULTRASONIC SENSORS

SCUA-130

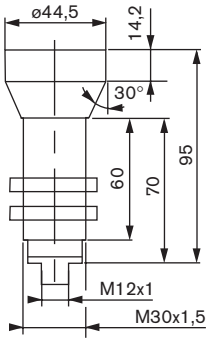
SCUA-140

Model	SCUA-130	SCUA-140
Power supply	15 to 30 VDC / max 30 mA	15 to 30 VDC / max 30 mA
Min. distance	100 mm	400 mm
Max. distance	1000 mm	2400 mm
Accuracy	±1 mm	±1 mm
Protection class	IP67	IP67
Accessory	5 m cable	5 m cable
Service manual	MC487	MC488

Dimmensions (mm)



SCUA-130



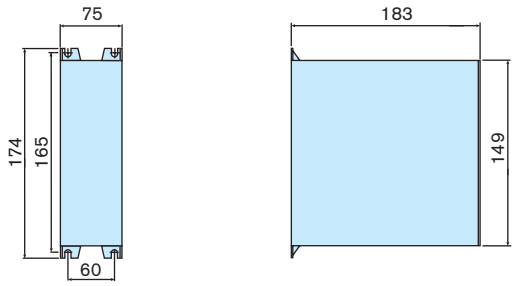
SCUA-140

ELECTRICAL AMPLIFIER MCS2000-PSDRV

❒ 1 alternative/continue current supply card
❒ 1 logic card with 2 individual channels
(1 fixed, 1 with calibration)

Model	Electrical input signal	Power supply / current	Output voltage / current
MCS2000-PSDRV	0 – 10 VDC	100 – 260 VAC	0-24 VDC/1,4 A
Wiring	Shielded cable		
Setting	Anti-residual		
Mounting position	Vibrations free, vertically		
Service manual	MC517		

Dimensions (mm)



ELECTRICAL AMPLIFIER MCS2000

MCS2000-DRV

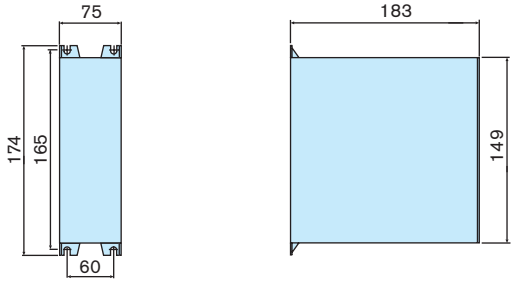
❒ 1 logic card with 2 individual channels
(1 fixed, 1 with calibration)

MCS2000-DRV8

❒ 1 logic card with 8 individual output channels

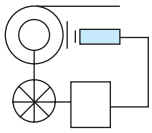
Model	Electrical input signal	Power supply / current	Output voltage / current
MCS2000-DRV	0 – 10 VDC	24 VDC/3 A	0-24 VDC/1,4 A
MCS2000-DRV8	0 – 10 VDC	24 VDC/3 A	0-24 VDC/0,3 A per channel
Wiring	Shielded cable		
Setting	Anti-residual		
Mounting position	Vibrations free, vertically		
Service manual	MC517		

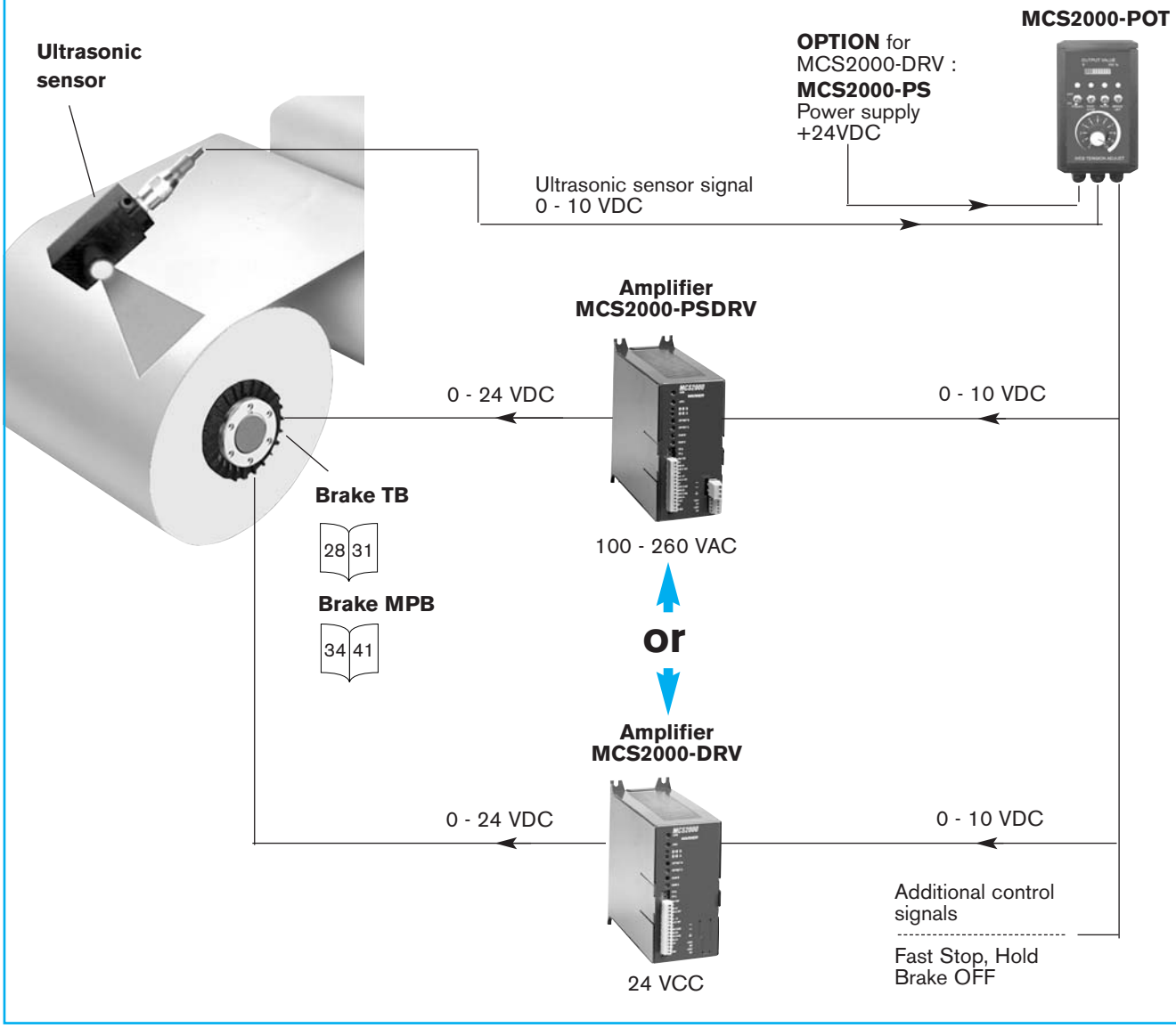
Dimensions (mm)



III - Tension control in open loop

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Diameter reading 	❒ The most commonly used solution in open loop ❒ Operator intervention admitted ❒ Large roll ø ratio	❒ Physical reading, no reset ❒ Easy to start-up ❒ Graphic display for output percentage value ❒ Functions control available remote/manually by operator	❒ Poor reading accuracy on core



Automatic setting by diameter reading

Ultrasonic sensors - Dimensions, see page 7

SCUA-130

SCUA-140

Model	SCUA-130	SCUA-140
Power supply	15 to 30 VDC / max 30 mA	15 to 30 VDC / max 30 mA
Min. distance	100 mm	400 mm
Max. distance	1000 mm	2400 mm
Accuracy	±1 mm	±1 mm
Protection class	IP67	IP67
Accessory	5 m cable	5 m cable
Service manual	MC487	MC488

Ultrasonic Diameter Sensing – MCS2000-POT

- ❒ A simple, analogue, open loop torque control.
- ❒ Power supply 24 VDC / Internal consumption 150 mA.
- ❒ Adjustable maximum level of the output signal relatively to the ultrasonic input level.
- ❒ Graphic display of the output level – full screen equal 10 VDC.
- ❒ FAST STOP, HOLD and BRAKE OFF can be activated either through the front switches or through the terminal bloc.
- ❒ FAST STOP and HOLD levels are adjustable via potentiometer.
- ❒ FAST STOP: a ratio of 1 to 10 times to OPERATING LEVEL
- ❒ OPERATING LEVEL: maximum 10 VDC divided by the FAST STOP ratio.
- ❒ HOLD: output level adjustable between 0 and 10 VDC

To be used ONLY with scalable ultrasonic sensors type SCUA-130 (1 m) or SCUA-140 (2.5 m)

- ❒ Service manual : MC520

Mounting and dimensions (mm)

Overall dimensions maximum:

Height	160 mm
Width	95 mm
Depth	75 mm
Weight	0,350 kg

ELECTRICAL AMPLIFIER MCS2000

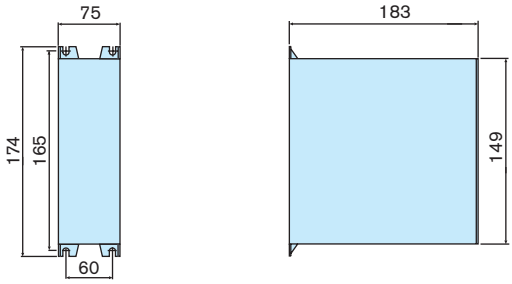
MCS2000-PSDRV
- ❒ 1 alternative/continue current supply card
- ❒ 1 logic card with 2 individual channels (1 fixed, 1 with calibration)

MCS2000-DRV
- ❒ 1 logic card with 8 individual output channels

MCS2000-DRV8
- ❒ 1 logic card with 8 individual output channels

Model	Electrical input signal	Power supply / current	Output voltage / current
MCS2000-PSDRV	0 – 10 VDC	100 – 260 VAC	0-24 VDC/1,4 A
MCS2000-DRV	0 – 10 VDC	24 VDC/3 A	0-24 VDC/1,4 A
MCS2000-DRV8	0 – 10 VDC	24 VDC/3 A	0-24 VDC/0,3 A per channel
Wiring	Shielded cable		
Setting	Anti-residual		
Mounting position	Vibrations free, vertically		
Service manual	MC517		

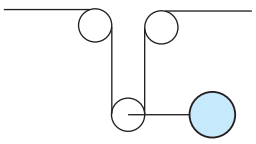
Dimensions (mm)

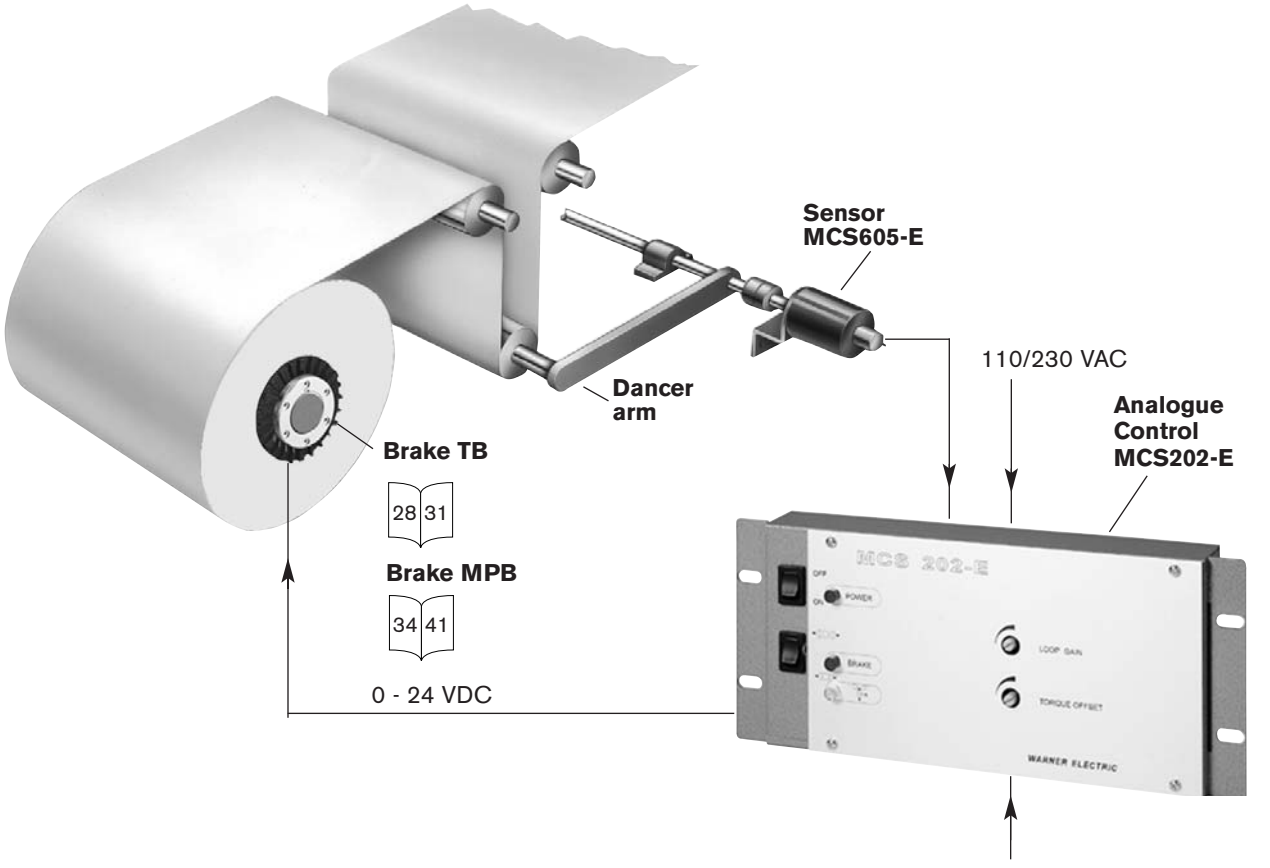


I - Simple tension control in closed loop

If your machine requires a very accurate web tension control, then you need to work in closed loop. An important unit in the loop is the sensor. Several possibilities are offered. The choice now depends on the kind of machine you are building, the mechanical construction and the max tension value you desire to control.

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Dancer arm 	❒ Printing machines ❒ Intermittent function ❒ Flying splice need	❒ Absorb tension peak ❒ Can act as store ❒ Easy flying splice ❒ Accel / decel machine phase well absorbed ❒ Flexibility	❒ Need more space ❒ Moving parts



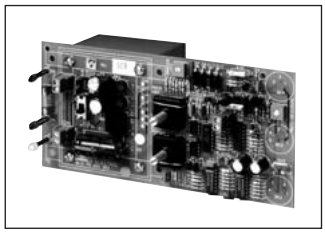
Additional functions

- ❒ Brake open
- ❒ Emergency stop
- ❒ Drift stop(stop integral term of PID)
- ❒ Gain change

Automatic setting by dancer arm

ROTARY SENSOR MCS605-E (see pages 16 and 17)

ANALOGUE CONTROL MCS202-E



- ❒ **MCS202-E1** Standard execution
- ❒ **MCS202-E54** Standard IP54 protected
- ❒ **MCS202-EC1** Open frame execution

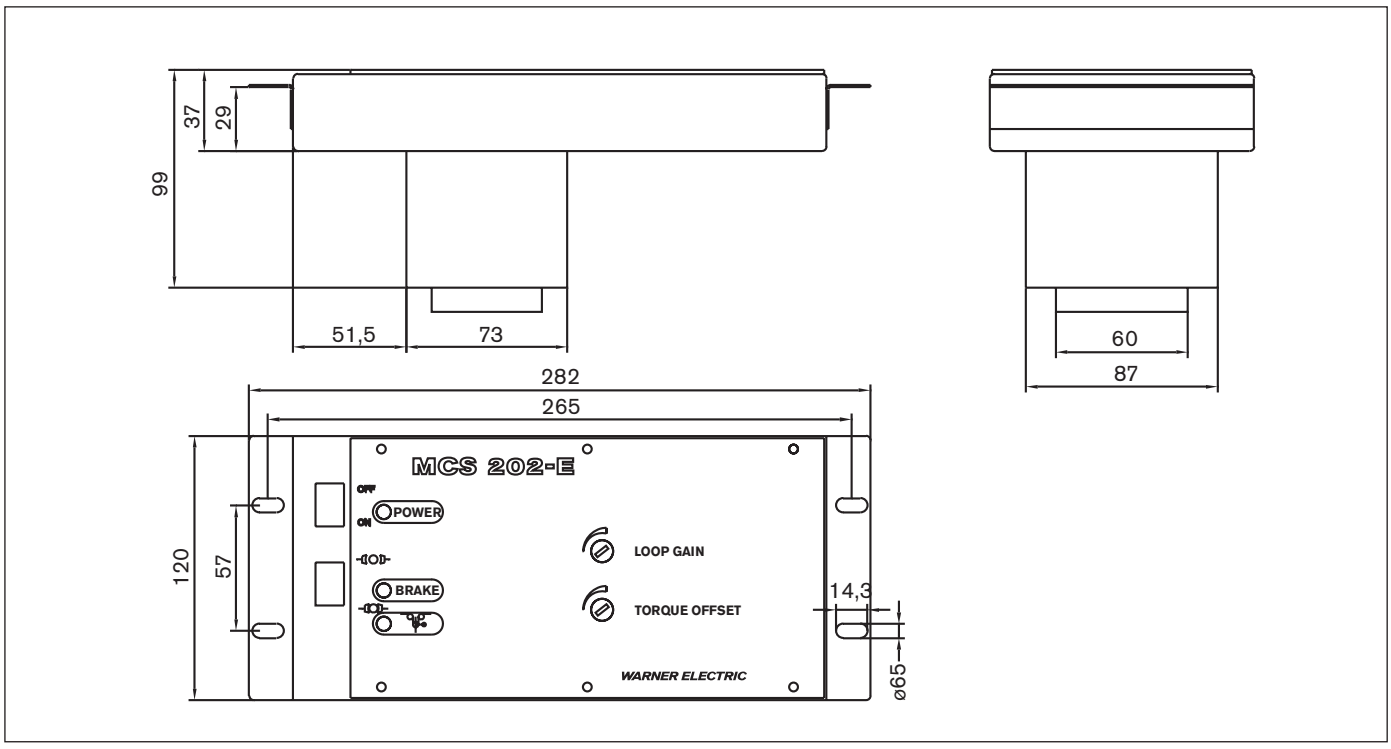
Technical characteristics – valid for 3 executions

	Range - Values	Comments
Power supply	110-220 VAC selectable	Open front face to access
Output current capability	Max 2, 5 Amps, short circuit protected	Able to power 2 TB in parallel
User settings	Loop gain	Front face potentiometer
	Offset torque	Front face potentiometer
Output voltage brakes	0-24 VDC	Compatible all elec. Warner Electric
Housing	Metal rugged housing	Only MCS202-E1 and –E54
Loop gain	2 adjustable range selection	Can be change during operation
Accessories	MCS-KIT1, 2, 3, 5 and 6	See details on page 17
Sensor compatible	Dancer arm with MCS605-E	See details on pages 16 and 17
Service manual	MC403	

Technical information

MCS202 control is based on classical and fixed PID terms. The loop gain can be set on front face potentiometer. Due to the fixed PID terms, its use is limited in terms of roll diameter ratio. One input is provided to change the loop gain and has to be used when diameter ratio exceeds 8. To ensure proper operation it is important to wire the function “Drift Stop”. This function releases the Integral term as soon as the machine runs.

Dimensions (mm)



Automatic setting by dancer arm

ROTARY SENSOR MCS605-E

A position sensor is used in 2 possible ways:

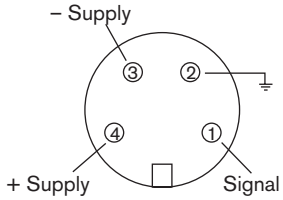
❒ *- To detect dancer moving in the closed loop installation working on dancer principle.*

❒ *To sense the diameter of the roll to operate open loop control or make PID compensation in closed loop installation.*

	MCS605-E
Power supply	10 to 30 VDC / 30 mA (or ± 5 to 15 VDC)
Max. detection angle	200° or ± 100°
Sensitivity	2,5 mV / V / °
Service manual	MC483

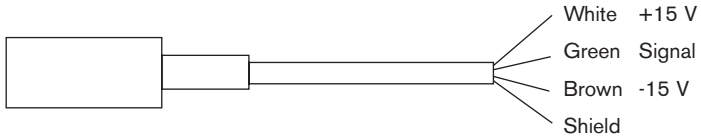
ELECTRICAL CONNECTIONS

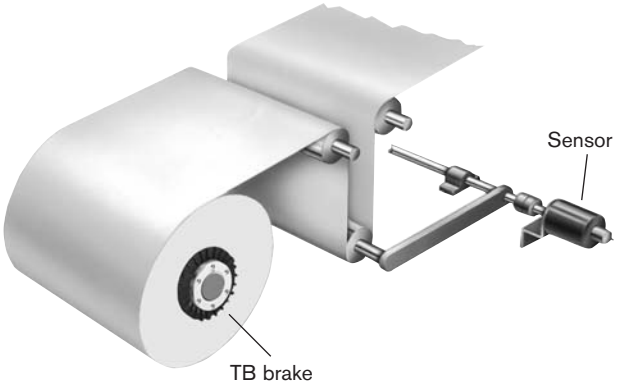
CONNECTOR



View from outside

CABLE





Working in closed loop with the arm dancer principle is very popular especially in the printing market where a good flexibility of the system is required to absorb the eventual "tension peaks". The rotary sensor is necessary to read the dancing roll movement.

MCS605-E is ideal for easy mounting. It is encapsulated in rugged metal housing preventing mechanical shocks. Furthermore it is provided with built in switch in order to change the signal output polarity.

MCS605-E ACCESSORIES

The **MCS202-Exx** is designed to work with dancer arm principle. Usually the sensor is a rotary type.

Warner Electric sensor **MCS605-E** are delivered with complete mounting kit.

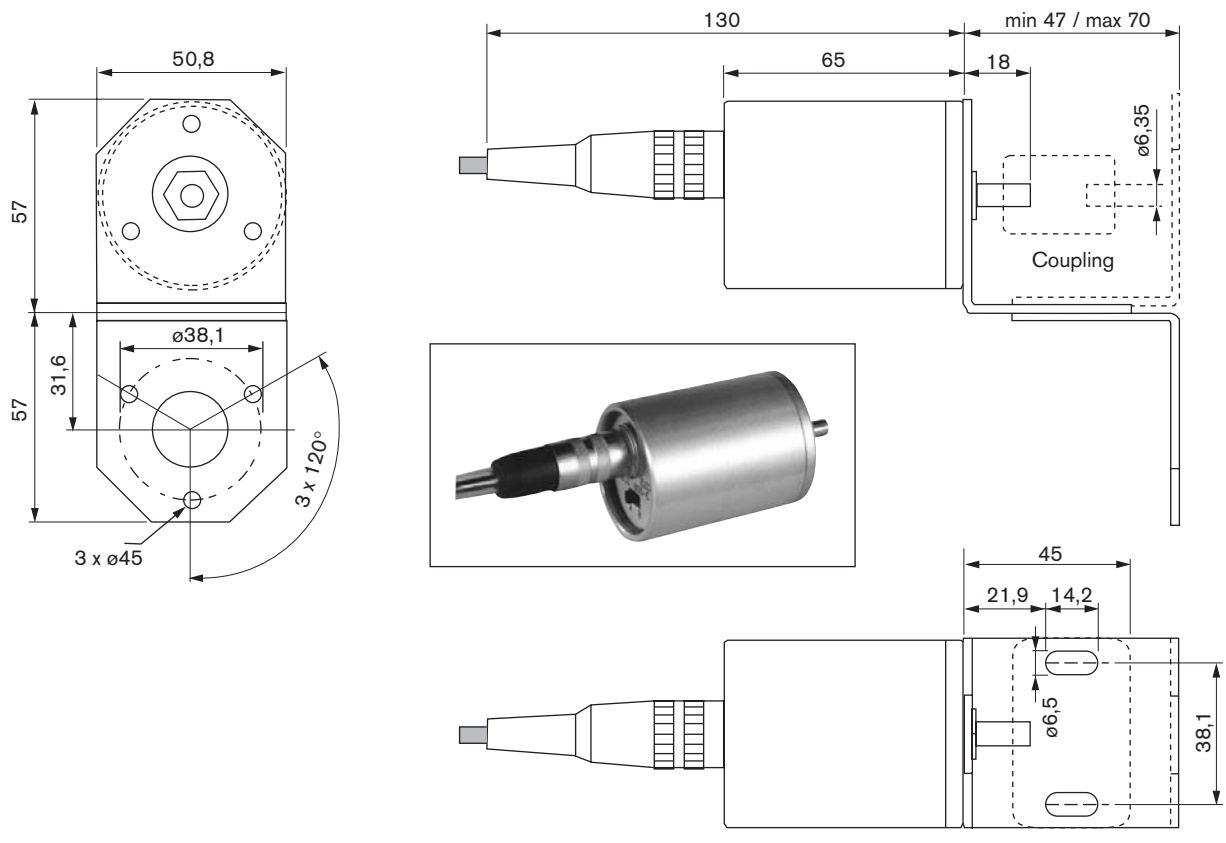
Mounting kit comprises of **CABLE, COUPLING, BRAKETS** and all necessary **SCREWS**. Various KITS have various lengths of cable and cable with or without connector at control end side.

MCS2000 line requires free leads (MCS2000 control line is provided with terminal block).

MCS202-Exx requires a connector (MCS202-Exx is provided with the connector).

	Cable length	One / Two connectors	Compatible
MCS-KIT1	3 m	2	MCS202-Exx
MCS-KIT2	3 m	1	MCS2000
MCS-KIT3	4,5 m	2	MCS202-Exx
MCS-KIT4	4,5 m	1	MCS2000
MCS-KIT7	6 m	2	MCS202-Exx
MCS-KIT8	8 m	1	MCS2000

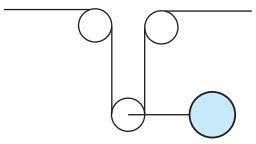
Dimensions (mm) – Mounting

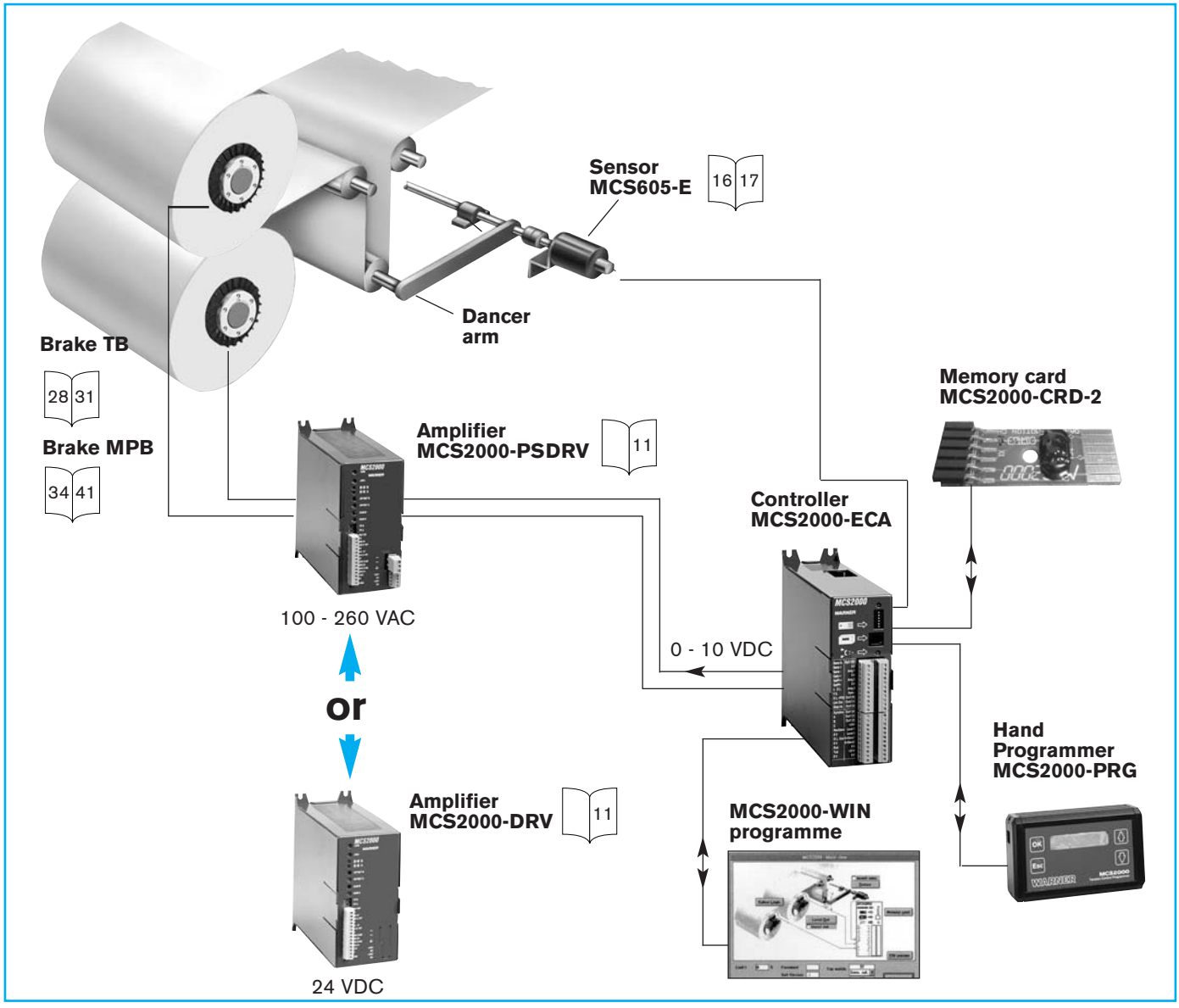


II - Double tension control in closed loop (modular)

MCS2000-ECA *is a digital controller that can be used in both open or closed loop. Operation in open and closed loop is also possible. It is mainly destined for OEM application. The programming tool is detachable. Sensor, sensor mounting kit, display are available as options. The unit has to be powered with 24 VDC.*

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Dancer arm 	❒ Printing machines ❒ Intermittent function ❒ Flying splice need	❒ Absorb tension peak ❒ Can act as store ❒ Easy flying splice ❒ Accel / decel machine phase well absorbed ❒ Flexibility	❒ Need more space ❒ Moving parts



Automatic setting by dancer arm

ELECTRICAL AMPLIFIERS MCS2000-PSDRV and MCS2000-DRV (see page 9)

ROTARY SENSOR MCS605-E (see pages 16 et 17)

CONTROLLER MCS2000-ECA

❒ Digital controller - 2 channels

Main Characteristics

❒ 24 VDC power supply unit
❒ PID parameters setting on line
❒ Automatic adaptation for PID parameters, splicing logic included
❒ Opto isolation for input and output
❒ Compatible PLC
❒ Automatic sensor scaling and output sensor information
❒ Programming easy by pocket keyboard or PC(Windows)
❒ Available in open loop as calculator
❒ 2 analogic input, 2 output channels
❒ Plugable memory card
❒ Three language available
❒ Most dedicated for unwinding and rewinding with electromagnetic brakes and clutches.
❒ Service manual : MC514

MCS2000-PRG - HAND PROGRAMMER

❒ 4 command keys only
❒ 2 x 16 characters display
❒ Menu in 3 languages
❒ Connectable and disconnectable during operation
❒ Supply by control MCS 2000-EC

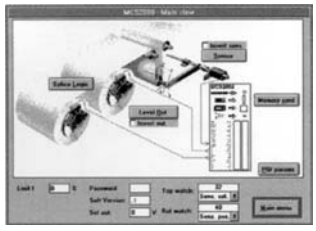
MCS2000-CRD-2 - MEMORY CARD

All setting data saved. It allows a quick loading operation on new machine or on running machine to optimise.

❒ Memory for 2 different programs
❒ Plugable on line in MCS2000-ECA unit

MCS2000-WIN – PROGRAMME

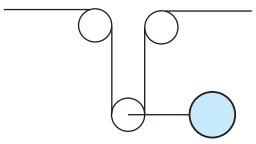
The program can modify the running setting by this software running with: Windows 95/98/XP/2000.

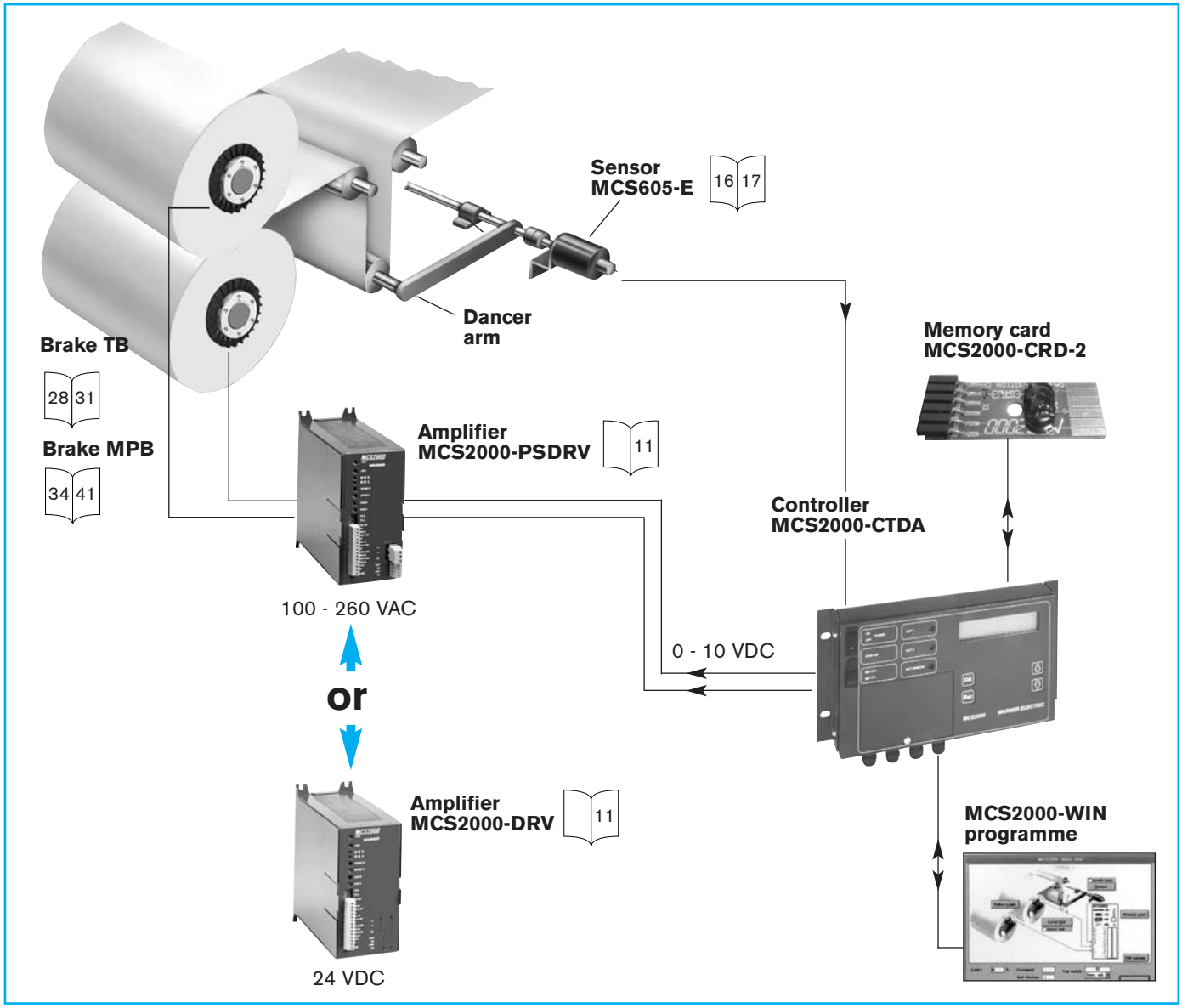


III - Double tension control in closed loop (compact)

The command unit **MCS2000-CTDA** *is a complete solution with power supply and programmer display integrated. There are 2 software version available. See technical data below*

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Dancer arm 	❒ Printing machines ❒ Intermittent function ❒ Flying splice need	❒ Absorb tension peak ❒ Can act as store ❒ Easy flying splice ❒ Accel / decel machine phase well absorbed ❒ Flexibility	❒ Need more space ❒ Moving parts



Automatic setting by dancer arm

ELECTRICAL AMPLIFIERS MCS2000-PSDRV and MCS2000-DRV (see page 9)

ROTARY SENSOR MCS605-E (see pages 16 et 17)

CONTROLLER MCS2000-CTDA

Main features

- ❒ Three mounting possibilities
- ❒ Software password protected
- ❒ Scrolling menu program
- ❒ Multipurpose application
- ❒ RS232 communication
- ❒ Two ouput channels
- ❒ Automatic sensor scaling
- ❒ Programmable output configuration
- ❒ Output sensor information
- ❒ External set point change
- ❒ Automatic or imposed PID correction
- ❒ All features requested for tension control
- ❒ Plugable memory card
- ❒ Variable tension value to prevent telescopic effect on unwinding – CTDA-22
- ❒ Service manual : MC525

Specifications

Input power supply	110-240 VAC selectable
Analogue inputs	
Two analogue inputs	0-10 VDC
Analogue outputs	
Two controlled channels	± 10 VDC, 0-20 mA
Open loop signal	0-10 VDC
Digital inputs	
Set point change +	active low
Set point change –	active low
Set point change ±	front face switch
Gain multiplier	active low
Output limitation	active low
ABC binary combination	active low
ABC inputs synchronisation	active low
Stop integral form	active low
Digital outputs	
Sensor level indication	Two binary outputs
Other outputs	
Power supply sensor	± 15 VDC / 100 mA
	± 5 VDC / 100 mA
Power supply	24 VDC
Voltage reference	+ 10 VDC / 10 mA

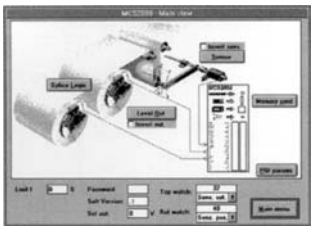
MCS2000-CRD-2 - MEMORY CARD

All setting data saved. It allows a quick loading operation on new machine or on running machine to optimise.

- ❒ Memory for 2 different programs
- ❒ Plugable on line in MCS2000-ECA unit

MCS2000-WIN – PROGRAMME

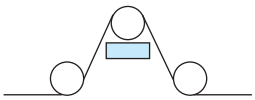
The program can modify the running setting by this software running with: Windows 95/98/XP/2000.

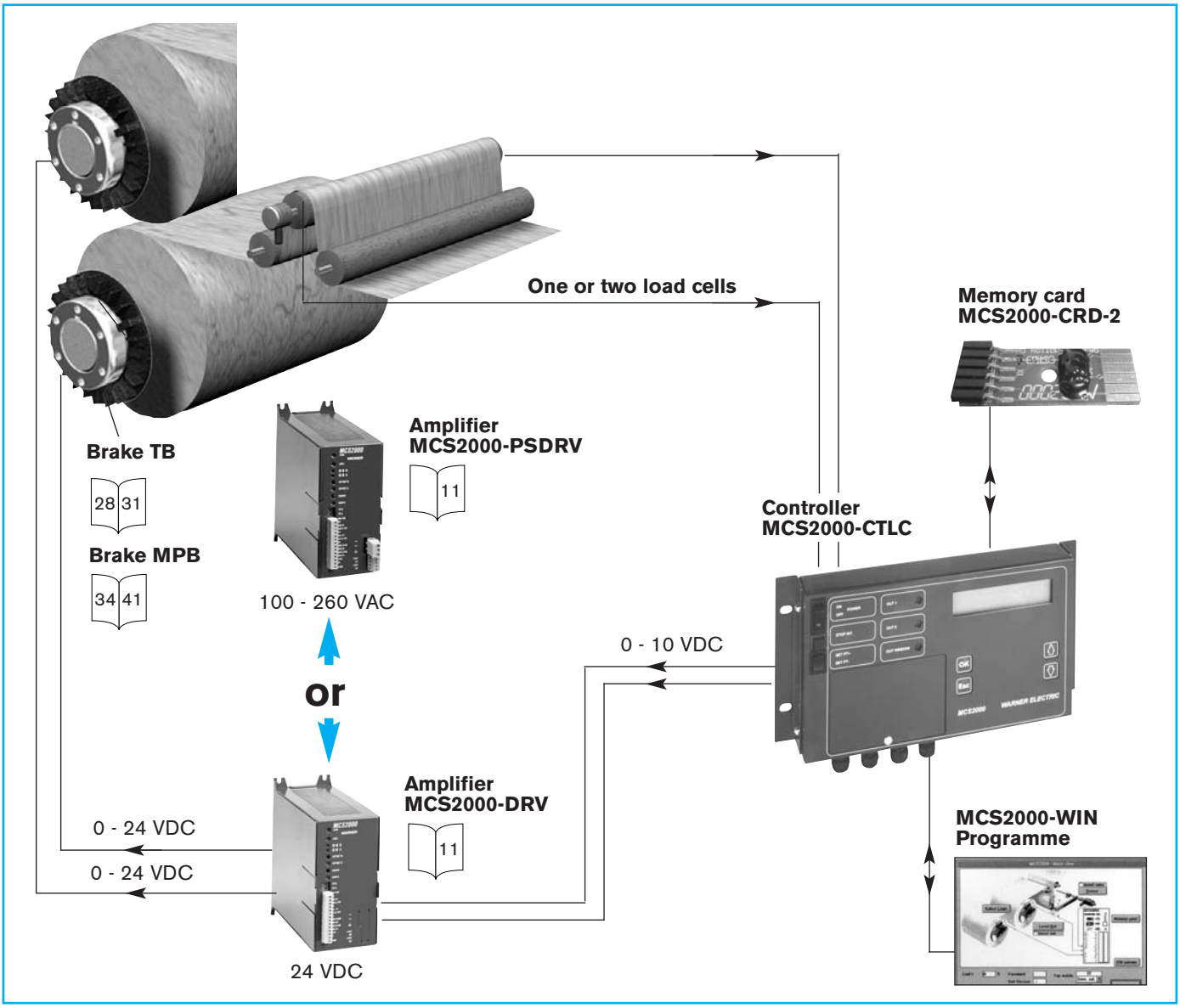


IV - Double tension control in closed loop

The command unit **MCS2000-CTLC** *is a complete solution with power supply and programmer display integrated. There are 2 software version available. See technical data below*

MAIN APPLICATIONS - ADVANTAGE – DISADVANTAGE

Setting type	Where, When, Why ?	Advantage	Disadvantage
Load cell 	❒ Slitter, Sheeter Coater ❒ For heavy material ❒ Limited room ❒ No fast accel/decel ❒ Tension peak accepted	❒ Direct tension measure ❒ Mechanically well integrated ❒ No moving part	❒ No tension peak absorption ❒ Accel/decel machine not easy to manage ❒ Flying splice function not easy



Automatic setting by load cell

ELECTRICAL AMPLIFIERS MCS2000-PSDRV and MCS2000-DRV (see page 9)

CONTROLLER MCS-2000-CTLC

Main features

- ❒ Three mounting possibilities
- ❒ Software password protected
- ❒ Scrolling menu program
- ❒ Multipurpose application
- ❒ RS232 communication
- ❒ Two ouput channels
- ❒ Automatic sensor scaling
- ❒ Programmable output configuration
- ❒ Output sensor information
- ❒ External set point change
- ❒ Automatic or imposed PID correction
- ❒ All features requested for tension control
- ❒ Plugable memory card
- ❒ Service manual : MC525

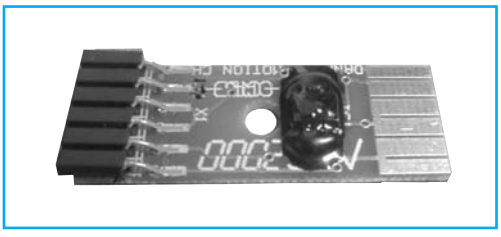
Specifications

Input power supply	110-240 VAC selectable
Analogue inputs	
Two analogue inputs	0-10 VDC
Analogue outputs	
Two controlled channels	± 10 VDC, 0-20 mA
Open loop signal	0-10 VDC
Digital inputs	
Set point change +	active low
Set point change –	active low
Set point change ±	front face switch
Gain multiplier	active low
Output limitation	active low
ABC binary combination	active low
ABC inputs synchronisation	active low
Stop integral form	active low
Digital outputs	
Sensor level indication	Two binary outputs
Other outputs	
Power supply sensor	± 15 VDC / 100 mA
	± 5 VDC / 100 mA
Power supply	24 VDC
Voltage reference	+ 10 VDC / 10 mA

MCS2000-CRD-2 - MEMORY CARD

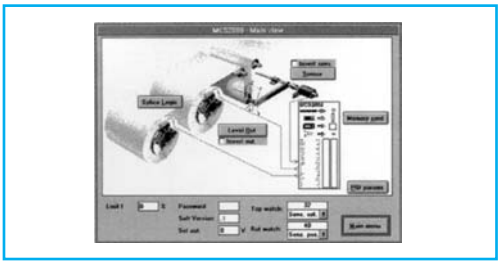
All setting data saved. It allows a quick loading operation on new machine or on running machine to optimise.

- ❒ Memory for 2 different programs
- ❒ Plugable on line in MCS2000-ECA unit



MCS2000-WIN – PROGRAMME

The program can modify the running setting by this software running with: Windows 95/98/XP/2000.



Load cells

The **FOOT MOUNTED LOAD CELL** *is the ideal solution to retrofit machines or for heavy tension measurement. The foot mounted model has to be installed with a pillow block type ball bearing supporting the sensing shaft.* **FM01A...** *and* **FM02-...** *are only differenciated by the physical dimensions.*

FOOT MOUNTED TYPE FM01A... and FM02-...

Foot mounted load cells are available in two versions:

With incorporated amplifier : **FM……..-AC**
AC = amplifier and connector on the load cell body

Without amplifier : **FM……..-C**
C = connector on load cell body

Specifications (all FM series)

	FM……..-AC	FM……..-C
Power supply	±12 to ±15 VDC	± 5 VCC or +10 VDC
Sensitivity	0-5 VDC, nominal load	10 mV, nominal load
Rating	100 – 250 – 500 – 1000 – 2500 – 5000 – 10000 N	
Connections	Cable supplied	
Permitted overload		
- Compression	150 %	
- Extension	120 %	
Radial permitted force	50%	
Dimensions	See mounting instructions ref. MC480	
Mounting	See recommendations on page 25	
Service manual	MC480	

AVAILABLE MODELS / CAPACITY

Nominal load	100 N	250 N	500 N	1000 N	2500 N	5000 N	10000 N
FM01A-	-100-AC	-250-AC	-500-AC	-1000-AC	-2500-AC	-5000-AC	
FM01A-	-100-C	-250-C	-500-C	-1000-C	-2500-C	-5000-C	
FM02..-						-5000-AC	-10000-AC
FM02..-						-5000-C	-10000-C

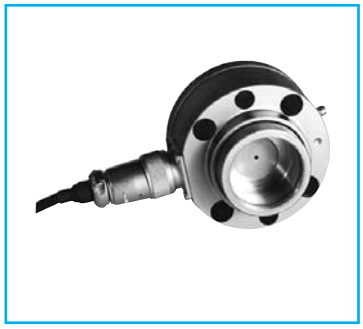
Load cells

END SHAFT LOAD CELLS *are normally used in new machines designed with the possibility to place the load cell directly on the sensing roll. The end shaft version offers the advantage of being able to easily place the load cell in any tension resultant direction. The* **ES** *model exists in two versions differenciated with the diameter of ball bearing which has to be placed in.*

All end shaft load cells are based on the Wheatstone bridge principle. They have no built in amplifier. They are delivering a signal which is proportionnal to the voltage supply and tension applied. It is important to respect the measurement direction referenced on the load cell body (normally an arrow indicates the sensitive direction).

ES..-... LOAD CELL FEATURES

	ES01-40C and ES02-52C
Power supply	10 to 15 VDC / 40 mA (±5 VDC in Warner Electric control)
Sensitivity	2 mV / V supply at nominal load
	1 mV / V supply for 50 and 150 N models
Rating	50-150-250-500-1000-2000 N
Connections	5 m shielded cable supplied
Mechanical overload	Max 150 % in any direction
Dimensions	See mounting instructions ref. MC481 and MC482
Mounting	See recommendations below
Service manual	MC481 and MC482

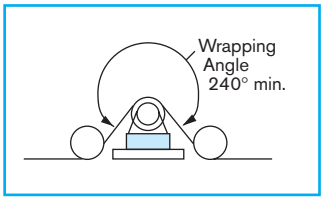


AVAILABLE MODELS / CAPACITY

Nominal load	50 N	150 N	250 N	500 N	1000 N	2000 N
ES01-...	-50-40C	-150-40C	-250-40C	-500-40C	-1000-40C	-2000-40C
ES02-...	-	-	-250-52C	-500-52C	-1000-52C	-2000-52C

LOAD CELLS SIZING - MOUNTING RECOMMENDATIONS

Please keep this principle in mind: **the load cell installed is destined to measure the WEB TENSION and not other constraints applied to it.**



Take the following points into consideration before selecting, sizing and installing material components.

❒ Load cells location should be vibration free. Vibrations will decrease quality measurement.

❒ The sensing shaft fitted on or in has to be very well balanced. Unbalanced shaft will create measurement oscillation, causing variations in control quality.

❒ Adapted ball bearing have to be used to avoid original stress on load cell (self-aligning ball bearing).

❒ Respect a reasonable sensing shaft weight/web tension measure ratio. **Less than 1.**

❒ Do not oversize the load cell respect to your calculation. **Max admitted factor 3, recommended 1,5.**

❒ Respect a minimum wrapping angle on load cell. **Min = 240°.**

❒ So far as it is possible, use load cell in compression, with web tension effect in same direction as the weight of shaft.

Tension brakes and clutches range

Brake and clutch types	Series	Main characteristics	Torque range	Pages
Electromagnetic brakes	**TB** Size 170 825 260 1000 425 1225 500 1525	Monodisc 24 VDC power supply	0,5 - 300 Nm	28 31
Electromagnetic brakes	**TBM** Size 10	Monodisc 24 VDC power supply	10 Nm	32 33
Magnetic particle brakes	**MPB** Size 2 15 70 120 240	Completely packaged and enclosed unit Shaft output 24 or 90 VDC power supply	0,04 - 27 Nm	34 41
Magnetic particle clutches	**MPC** Size 2 15 70 120	Completely packaged and enclosed unit Both end shaft output 24 or 90 VDC power supply	0,04 - 13,2 Nm	34 42
Permanent magnetic brakes	**MB** Size 1 5 1,5 5,5 2 6 3 9 4	Completely packaged and enclosed unit Shaft output Manual setting	0 - 33 Nm	43 50
Permanent magnetic clutches	**MC** Size 1,5 5 2 5,5 3 6 4 9	Completely packaged and enclosed unit Bore output Manual setting	0,07 Ncm - 33 Nm	43 50

Tension brake sizing

Two important parameters are used in brake selecting:
❒ *Max. torque requirement*
❒ *Max. thermal power to be dissipated*

These two values are determined by the application (see calculation example on pages 52-53).

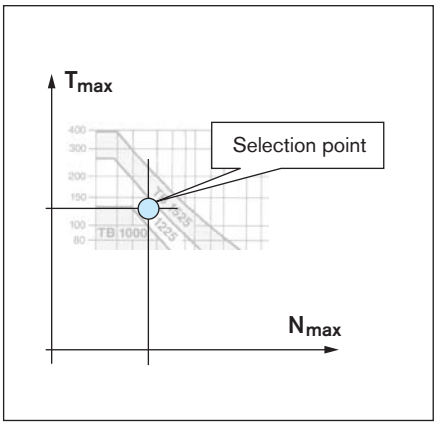
ELECTROMAGNETIC BRAKE TYPE TB – SELECTION

TB brake selection is based on two values :

Max torque need (Nm) on the brake

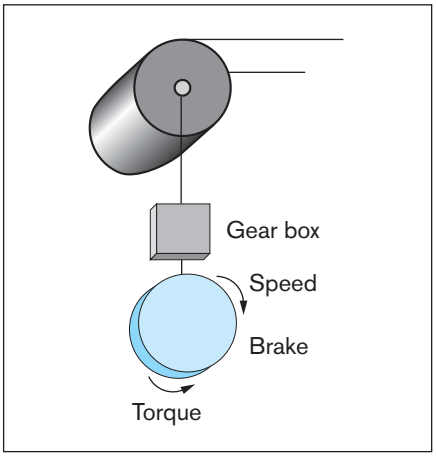
***Max brake rotation speed for the max torque (rpm)**

* As the curve given for TB selection takes the power dissipation into account, this value is used.



T_{max} = torque needed at the brake for the max tension in material and the max roll diameter - taking any gear ratios into account.

N_{max} = brake rotation **speed** for the max linear speed and the max roll diameter – taking any gear ratios into account.

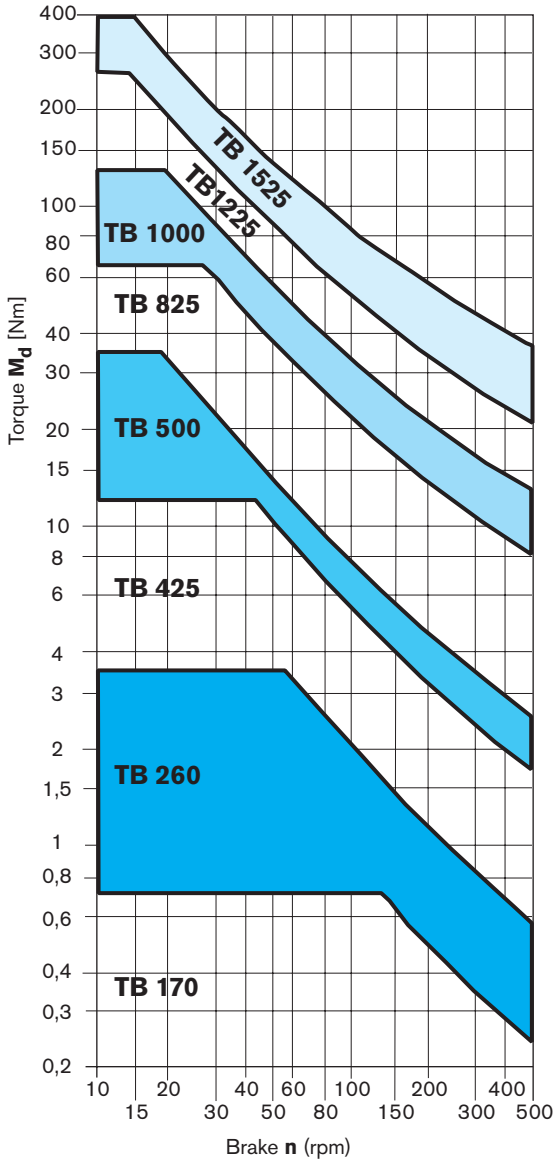


Note : the constant tension in the web gives a constant power on the brake. However, we make the selection for the max torque (then at full roll diameter) because it's the moment where the brake has the least natural cooling.

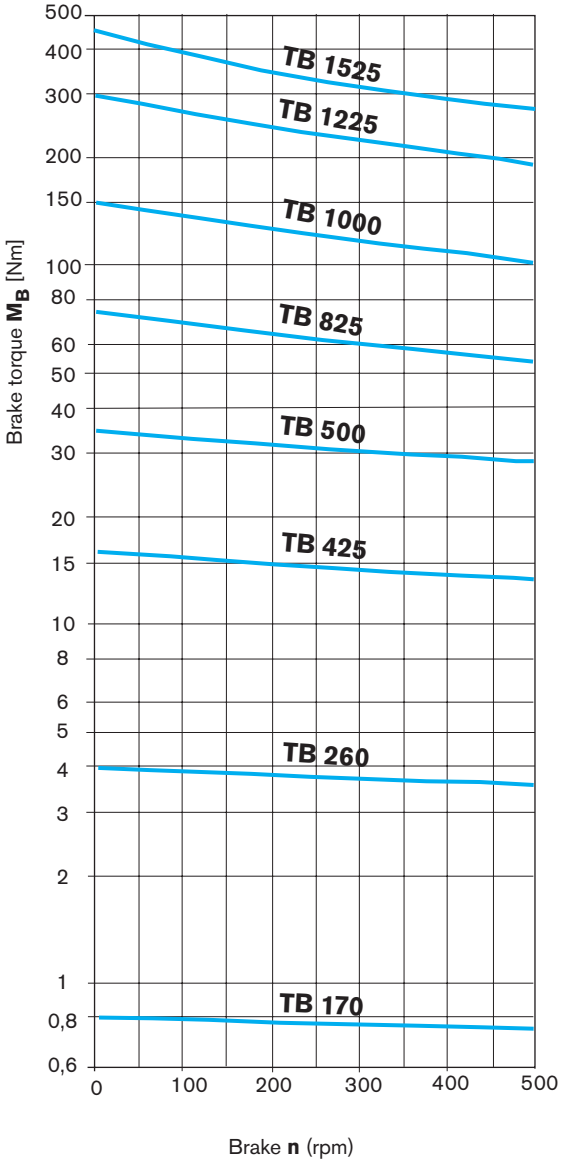
TB brake selection

The table (pictured below left) illustrates the selection of the correct **TB brake**. *The table on the right determines the maximum torque provided by the brake when nominal voltage is applied. After selection you can consult the complete brake characteristics and dimensions on pages 30 to 31.*

Dynamic braking torque
TB170 - TB1525

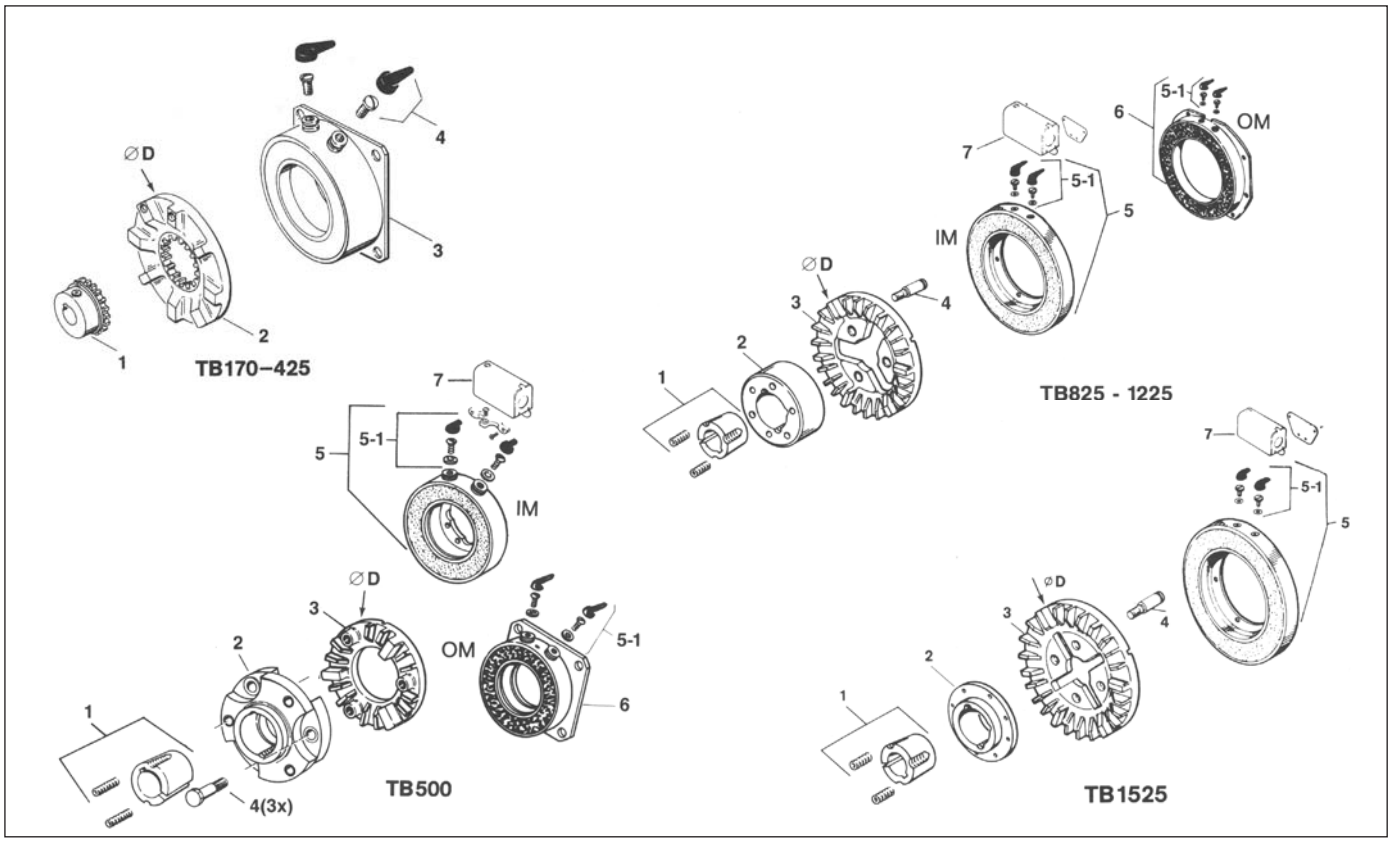


Maximum braking torque (emergency stop)
TB170 - TB1525



TB brake characteristics

TB units are assembled using various parts described below. Main components of the brake are armature and magnet. Additional parts are offered to provide for ease of mounting.



	Part	TB170	TB260	TB425
		D = 46 mm	D = 69 mm	D = 111 mm
1	Armature hub*	B5102-541-001-38	B5103-541-001-47	B5104-541-001-31
2	Armature	K110-0096	K110-0097	K110-0098
3	Magnet 24V	K375-631-012 R = 110 Ω, 20°C	K5365-631-016 R = 60 Ω, 20°C	K5367-631-008 R = 76 Ω, 20°C
4	Terminals	Wires	B5103-101-002	B5103-101-002

* Prebored

** Indicate bore and keyway

	Part	TB500
		D = 130 mm
1	Taperlock bushing**	B180-xxxx-xxxx
2	Armature hub	K5300-541-004
3	Armature	B110-0047
4	Drive pins	K5300-101-003 3 x
5	Magnet IM 24V	B5300-631-040
5-1	Terminals	B5311-101-001
6	Magnet OM 24V	B5300-631-000-46
7	Conduit box	K5200-101-010

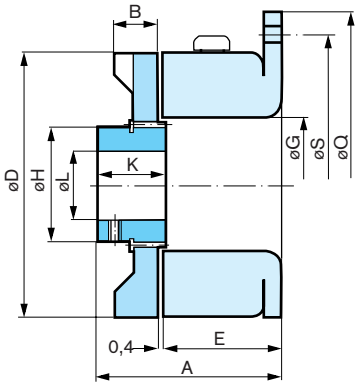
	Part	TB825	TB1000	TB1225	TB1525
		D = 215 mm	D = 259 mm	D = 316 mm	D = 395 mm
1	Taperlock bushing**	B180-xxxx-xxxx	B180-xxxx-xxxx	B180-xxxx-xxxx	B180-xxxx-xxxx
2	Armature hub	B540-0394	B540-0313	B540-0015	B540-0314
3	Armature	B5301-111-019	B5302-111-021	B5303-111-011	B5304-111-005-04
4	Drive pins	B5301-101-001 3 x	B5301-101-001 3 x	B5301-101-001 4 x	B5301-101-001 4 x
4	Magnet IM 24V	B5311-631-000-30 R = 20 Ω, 20°C	B5312-631-000-36 R = 20 Ω, 20°C	B5313-631-000-11 R = 22 Ω, 20°C	B5314-631-000-08 R = 20 Ω, 20°C
5-1	Terminals	B5311-101-001	B5311-101-001	B5311-101-001	B5311-101-001
6	Magnet OM 24V	B5311-631-000-16	-	-	-
7	Conduit box	K5200-101-011	K5200-101-011	K5200-101-011	K5200-101-011

TB brake characteristics

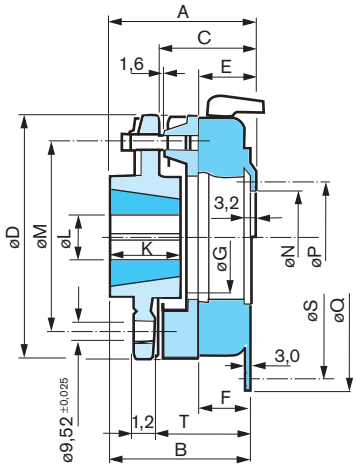
All **TB brakes** *are rated at 24 VDC nominal. When selection is correct the voltage on the brake should be approximately 12 VDC for your maximum parameters used in calculation. All* **TB brakes** *are able to work for short periods of time (less than 10 seconds) in the 12-24 VDC range, for example in machine deceleration or in emergency stop.*

Technical data and dimensions

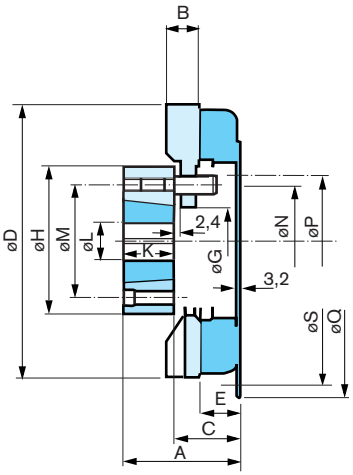
TB170, TB260, TB425



TB500 IM



TB825 IM, TB1000 IM, TB1225 IM



TB500 OM

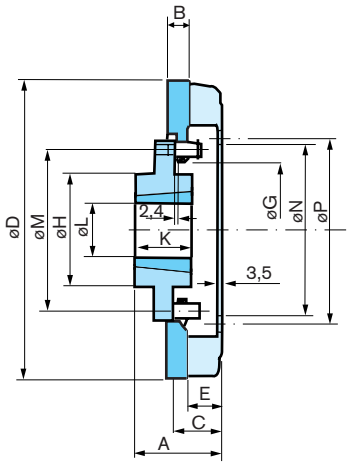
TB825 OM, TB1000 OM, TB1225 OM

Size		TB170	TB260	TB425	TB500	TB825	TB1000	TB1225	TB1525
M_d	[Nm]	0,8	4	16,5	35	75	150	300	450
M_d min	[Nm]	0	0,08	0,16	0,2	0,5	1,1	2	3
n max	[rpm]	5000	5000	5000	5000	3000	2400	2000	1600
I 24V =	[A]	0,22	0,40	0,32	1,010	1,177	1,224	1,076	1,212
P* Continu	[kW]	0,015	0,030	0,060	0,100	0,200	0,360	0,520	0,810
P* Alternativ	[kW]	0,022	0,045	0,100	0,180	0,360	0,650	0,950	1,580
R 20° C	[Ω]	110	60	76	23,8	20,4	19,6	22,3	19,8
t_b	[s]	0,020	0,040	0,080	0,052	0,112	0,152	0,290	0,310
Inertia	[kgm²]	$12 \cdot 10^{-6}$	$116 \cdot 10^{-6}$	$1,4 \cdot 10^{-3}$	$1,9 \cdot 10^{-3}$	0,022	0,041	0,095	0,213
Mass	[kg]	0,180	0,650	1,800	2,3	8,2	12	21	27,5
A	[mm]	30,5	48,5	52	79	94	105	138	116
B	[mm]	7	12	14	77	30,5	30,5	30,5	30,5
C	[mm]	-	-	-	51	54	56,5	62	65
øD	[mm]	46	69	111	130	215	259	316	395
E	[mm]	20,6	32	30,5	30,5	33,5	36,5	41,5	44,5

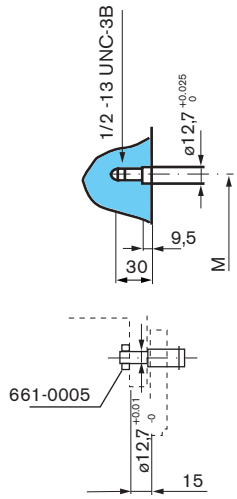
* Alternativ duty based on 30 minutes ON and 30 minutes OFF.

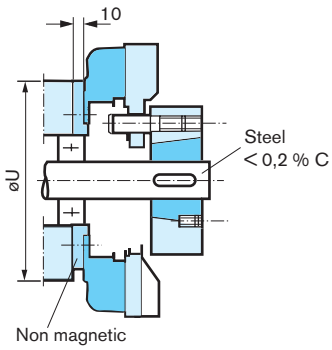
TB brake characteristics

TB1525 IM



TB825 - 1525



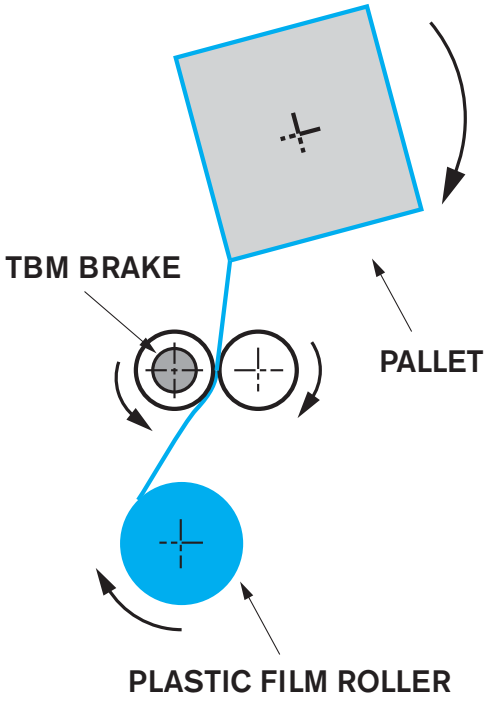


Size		TB170	TB260	TB425	TB500	TB825	TB1000	TB1225	TB1525
F	[mm]	-	-	-	28,5	-	-	-	-
øG	[mm]	$19{,}5^{+0{,}05}$	35	62	49	55	98	114	180
øH	[mm]	15,9	30,1	31,8	-	118	159	175	152,5
K*	[mm]	10,3	17,5	22,2	38	38	44,5	76	76
øL max	[mm]	10	20	22	32	42	60	75	75
$øM^{\pm 0{,}025}$	[mm]	-	-	-	98,42 3 × 120°	90,49 3 × 120°	133,4 3 × 120°	149,3 4 × 90°	215,9 4× 90°
$øN^{\pm 0{,}05}$	[mm]	-	-	-	52,40	88,93	136,55	161,95	228,60
øP (for screw)	[mm]	- -	- -	- -	60,3 8 × M4	108 6 × M8	155,6 6 × M8	184,1 6 × M8	247,60 12 × M8
$øQ_{-0{,}05}$	[mm]	61,9	88,9	142,47	165,10	247,62	-	-	-
øS (for screw)	[mm]	54 4 × M4	79,4 4 × M4	127 4 × M6	149,2 4 × M10	255,5 4 × M8	- -	- -	- -
T	[mm]	-	-	-	49	-	-	-	-
øU	[mm]	-	-	-	110	170	220	260	340

* Reverse mounting of taperlock bushing is possible

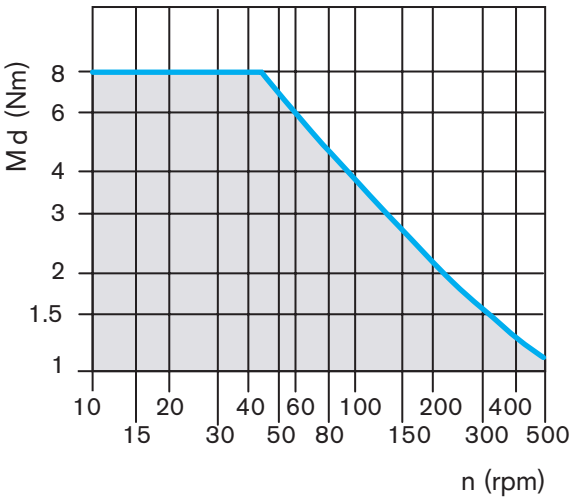
Tension brake for strapping machine

Specially designed for strapping machine, the **electromagnetic brake TBM10** *is adjustable for the different kind of plastic film. Mounted on the intermediate roller, it will tighten the plastic film and will permit a perfect strapping.*

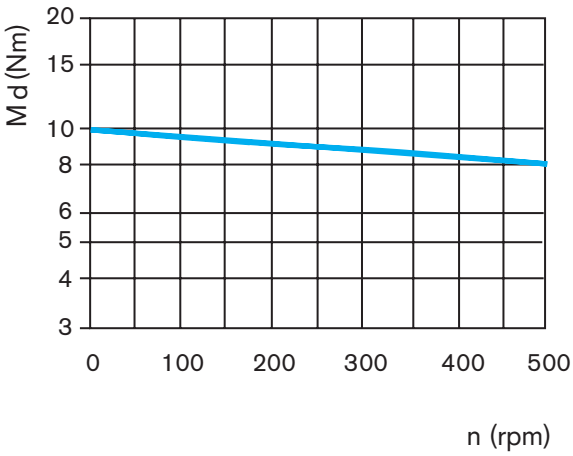


TBM SIZE 10

Heat dissipation torque

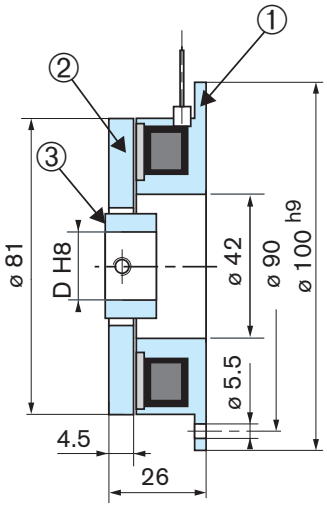


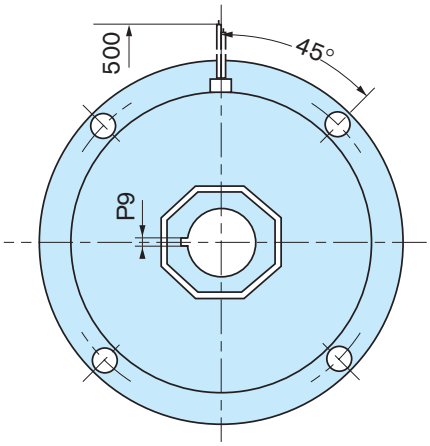
Brake torque



TBM SIZE 10

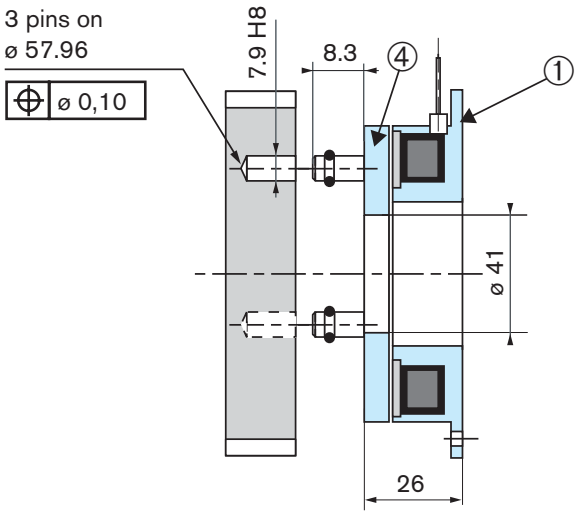
VAR 03





D min = 8 mm with standard keyway
D min = 13 mm with standard keyway

VAR 04



Keway according to : ISO R773 / BS 4235 / NFE 22175 / tolerance P9

U max : 24 VDC - P 20°C = 10,8 Watts

	Part	TBM TAILLE 10
1	Inductor 24VDC	B6650-631-000-39
2	Armature VAR03	B110-0000-1358
3	Hub prebored ø7,5	B540-0000-2519
	Hub ø12 H8 + Keyway 4 P9	B540-0000-2517
4	Armature VAR04	B6650-111-000-08

Magnetic particle clutches and brakes

Accurate torque control with instantaneous engagement!

Warner Electric Precision Tork™ magnetic particle clutches and brakes are unique because of the wide operating torque range available. Torque to current is almost linear and can be controlled very accurately.
The unique features of the magnetic particle clutches and brakes make them ideal for :

- ❒ tension control
- ❒ load simulation
- ❒ cycling/indexing
- ❒ soft starts and stops

Specials are our business

Special Shaft Configurations
❒ Customer specified shaft configurations for easy machine mounting and retrofitting.

Wash Down Environment
❒ Stainless steel units available for extreme environments.

Special Torque
❒ Maximum torque configurations to meet customer specifications.

Metric units
❒ On request, regarding quantities

Features and Benefits

Torque independent of slip speed
❒ Torque is transmitted through magnetic particle chains which are formed by an electromagnetic field. The torque is independent of slip speed, depending only on circuit current, and is infinitely variable from 0 (disengaged) to rated torque.

Precise engagement
❒ Precision Tork magnetic particle clutches and brakes engage to transmit torque with speed and precision. Response of the particles to the field is virtually instantaneous, providing perfectly controlled, jerk-free engagement.

Customer specified engagement
❒ Engagement time may be very gradual or extremely fast. The frequency and torque of the engagement/disengagement sequence is limited only by the capabilities of the control circuitry.

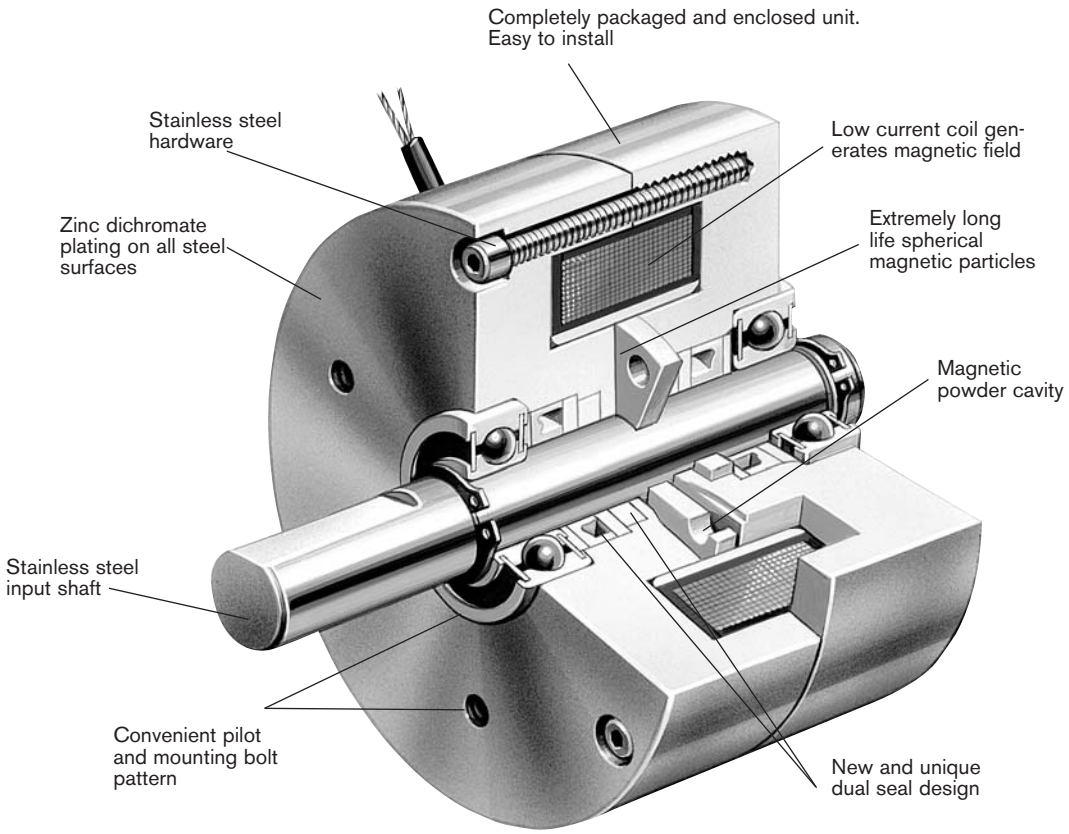
No wearing parts
❒ There are no friction surfaces to grab or wear, and the units are not affected by changes in atmospheric or other environmental conditions.

Efficient/Compact design
❒ High torque to size ratio and low consumption of electric power.

Versatile mounting
❒ Convenient bolt circle for easy mounting.
❒ Mounting brackets available for all sizes.
❒ Brakes are available with solid shafts and through bore.
❒ Can be mounted horizontally or vertically to solve virtually any motion control requirement.

Modular
❒ Customised products
❒ Interchangeable with industry standard sizes

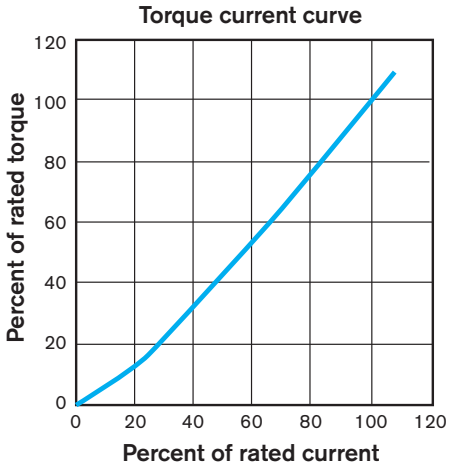
Design and operation



Operating Principles

The magnetic particle unit consists of four main components:

1) Housing
2) Shaft/disc
3) Coil
4) Magnetic powder



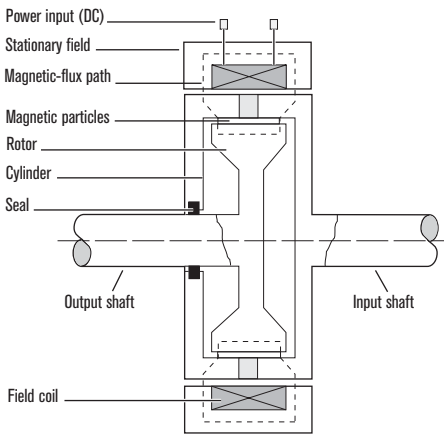
The coil is assembled inside the housing. The shaft/disc fits inside the housing/coil assembly with an air gap between the two; the air gap is filled with fine magnetic powder.

Engagement

When DC current is applied to the magnetic particle unit, a magnetic flux (chain) is formed, linking the shaft/disc to the housing. As the current is increased the magnetic flux becomes stronger, increasing the torque. The magnetic flux creates extremely smooth torque and virtually no “stick-slip”.

Disengagement

When DC current is removed the magnetic powder is free to move within the cavity, allowing the input shaft to rotate freely.



Selection

Sizing

To properly size magnetic particle clutches or brakes the thermal energy (slip watts) and torque transmitted must be considered. If thermal energy and torque are known for the application, select the unit from the charts to the right.

Speed

$$V\ (RPM)^{*} = \frac{\text{Velocity (m/min)}}{\pi \cdot \text{ø coil}^{**}\ (m)}$$

* In rewind applications the motor RPM should be higher (10%) than the fastest spool RPM.
** In applications with the web running over a pulley or in a nip roll application use the pulley diameter as the roll diameter.

Thermal Energy (slip watts)

1- When a brake or clutch is slipping, heat is generated. Heat is described in terms of “energy rate” and is a function of speed, inertia, and cycle rate.

For continuous slip applications, such as tension control in an unwind or rewind application slip watts are calculated using the following formula:

$$\text{Slip Watts} = 0{,}103 \cdot \text{torque (Nm)} \cdot \text{speed (RPM)}$$

2- For cycling applications heat is generated intermittently, and is calculated using the following formula:

$$\text{Slip Watts} = 0{,}00077 \cdot J\ (kgm^2) \cdot \frac{\text{speed}\ (RPM)^2}{10000} \cdot f\ \frac{\text{cycle}}{\text{min}}$$

The average heat input must be below the clutch or brake’s heat dissipation rating. If the application generates intermittent heat dissipation, use the average speed for the thermal energy (slip watts) calculations.

Torque

1- Tension applications calculate torque as a function of roll radius and tension.

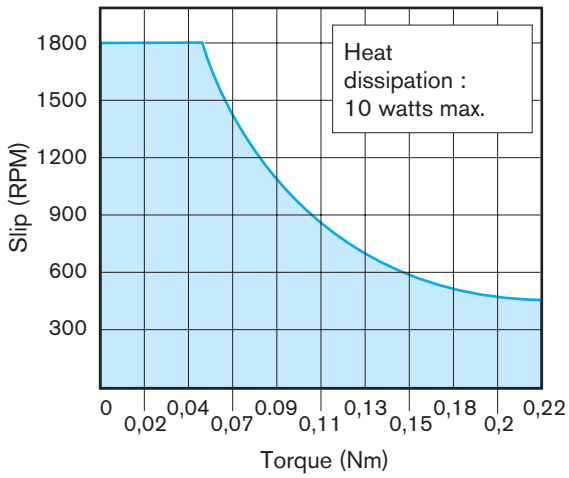
$$C\ (Nm) = \frac{T\ (N) \cdot D}{2}$$

2- Soft/controlled stopping applications calculate torque as a function of inertia, speed and desired time to stop the load.

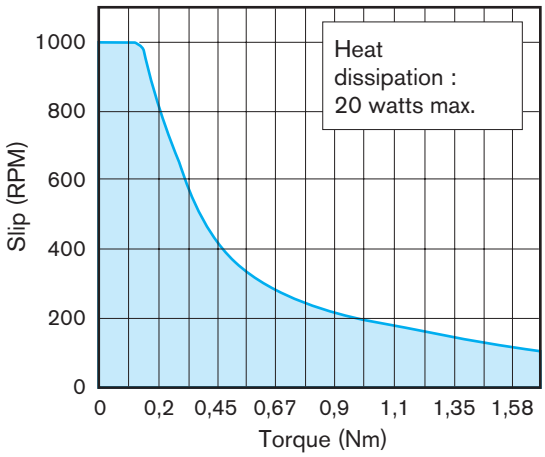
$$C\ (Nm) = \frac{J\ (kgm^2) \cdot N\ (RPM)}{9{,}55 \cdot \text{Time (s)}}$$

Quick Selection Charts

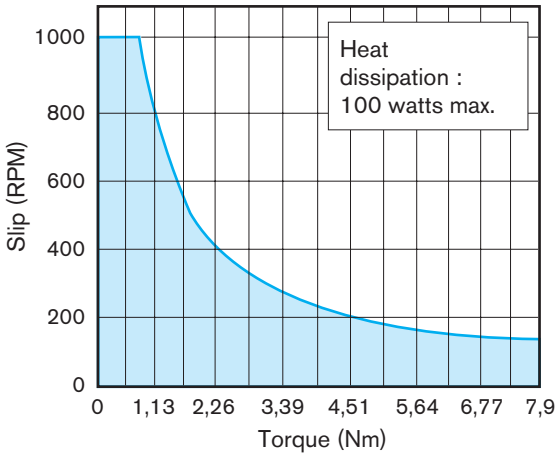
MPB2 / MPC2



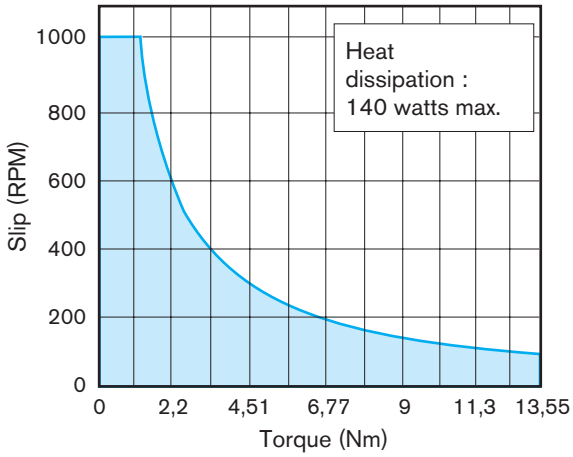
MPB15 / MPC15



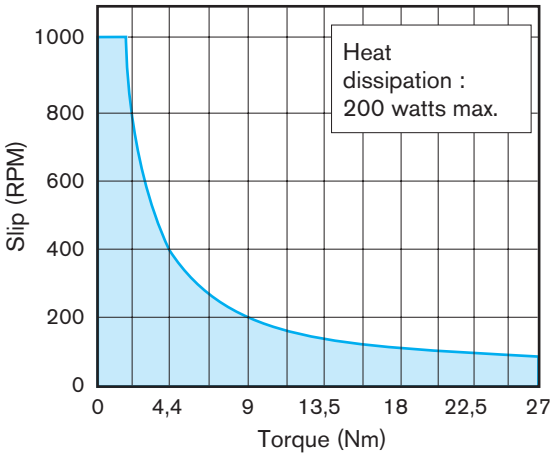
MPB70 / MPC70



MPB120 / MPC120



MPB240



Magnetic particle clutches and brakes

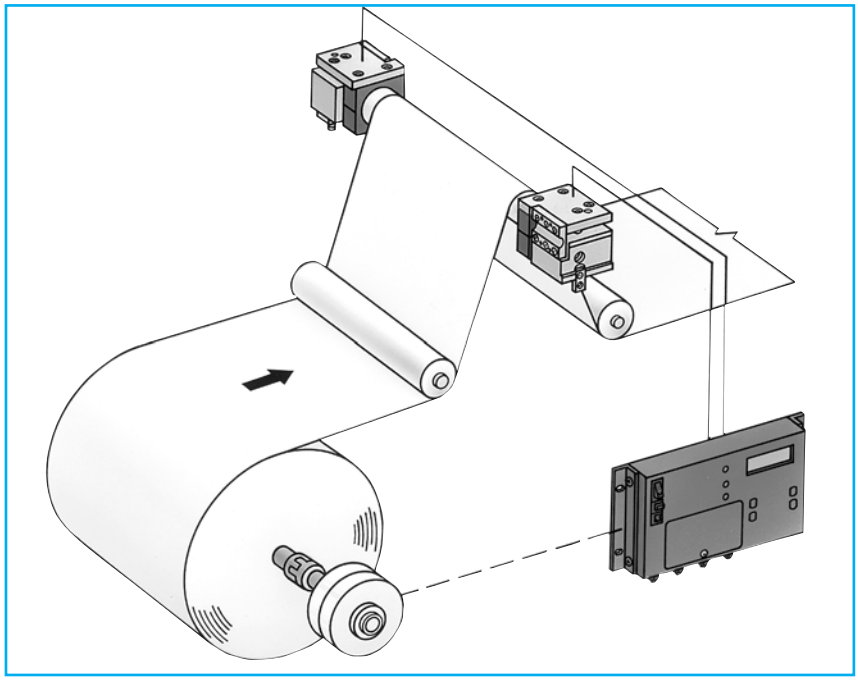
Applications

Warner Electric Precision Tork™ magnetic particle clutches and brakes are the ideal solution for controlling and maintaining torque. If the application is tensioning, load simulation, torque limiting, or soft starts and stops the magnetic particle unit is the preferred torque controlling device.

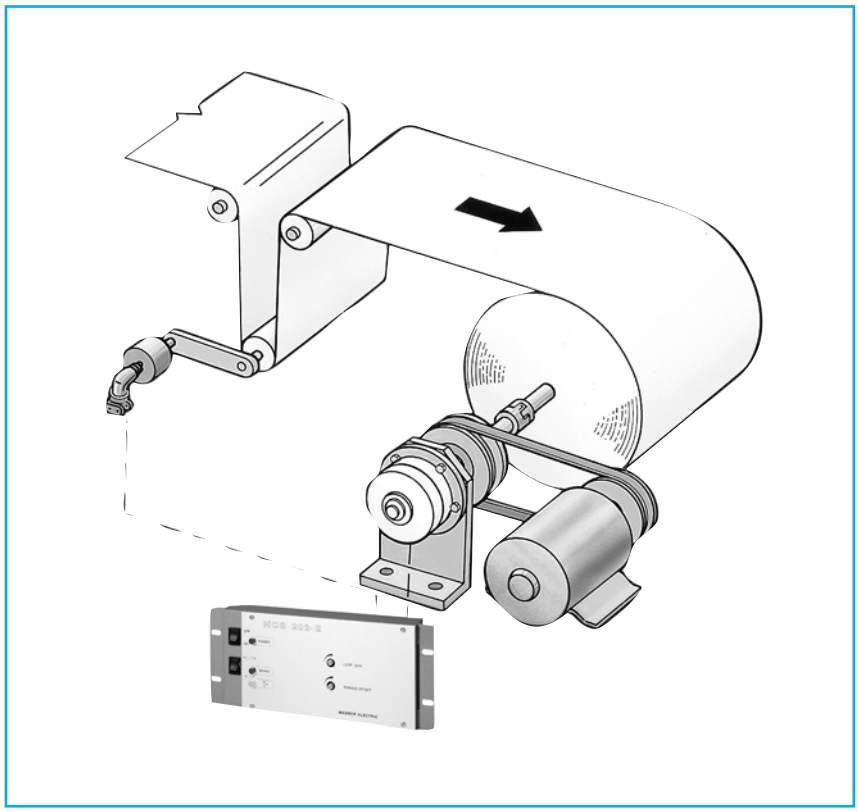
Typical Applications

- ❒ Wire Processing (winding, hooking, cutting)
- ❒ Paper/Foil/Film Processing
- ❒ Labelling Applications
- ❒ Textile Processing
- ❒ Load profile simulation on:
  - Exercise Equipment
  - Flight Simulators
  - Healthcare Equipment
- ❒ Life testing on:
  - Motors
  - Gears
  - Pulleys
  - Belts
  - Chains
  - Many other Rotating Devices
- ❒ Conveyors
- ❒ Bottle Capping

Unwind stand under load cell control



Rewind stand under dancer control



Magnetic particle clutches and brakes

Tensioning

Magnetic Particle clutches and brakes offer smooth controlled torque for tensioning in both the unwind zone and rewind zone. Torque produced from the magnetic particle clutches and brakes is independent of slip speed, offering a distinct advantage over competing technologies. Since torque can be varied infinitely by varying the input current, the magnetic particle clutches and brakes are ideal in an open loop system. To close the loop in the tensioning system, combine the magnetic particle clutch or brake with a Warner Electric sensor and control, resulting in more precise control of tension.

Particle clutches and the MCS2000-CTDA control provide accurate closed loop tension control for rewind applications.

Application example:

Information required: Full roll ø : 0,5 m
Tension : 22 N
Velocity : 122 m/min

Max. torque $= \frac{\text{tension} \cdot \text{full roll ø}}{2}$

$= \frac{22 \cdot 0{,}5}{2}$

$= 5{,}5$ Nm

Slip $= \frac{\text{Velocity}}{\pi \cdot D}$

$= \frac{122}{\pi \cdot 0.5}$

$= 78$ RPM

Heat dissipation $= 0{,}103 \cdot \text{torque} \cdot \text{slip}$

$= 0{,}103 \cdot 5{,}5 \cdot 78$

$= 44{,}46$ watts

Select a brake that exceeds the maximum torque and thermal energy requirements from Quick Selection Chart – **MPB70**.

Particle clutches and the MCS202-E1 control provide accurate closed loop tension control for rewind applications.

Application example:

Information required: Core ø : 0,08 m
Full roll ø : 0,23 m
Tension : 22 N
Velocity : 90 m/mn
Input speed : 500 RPM*

Max. torque. $= \frac{\text{Tension} \cdot \text{full roll ø}}{2}$

$= \frac{22 \cdot 0.23}{2}$

$= 2{,}53$ Nm

$= \frac{\text{Speed}}{(\pi \cdot d)}$

$= \frac{90}{(\pi \cdot 0{,}08)}$

$= 358$ RPM

Full roll ø $= \frac{\text{Speed}}{(\pi \cdot D)}$

$= \frac{90}{(\pi \cdot 0{,}23)}$

$= 125$ RPM

Slip $=$ Input speed – Full roll ø

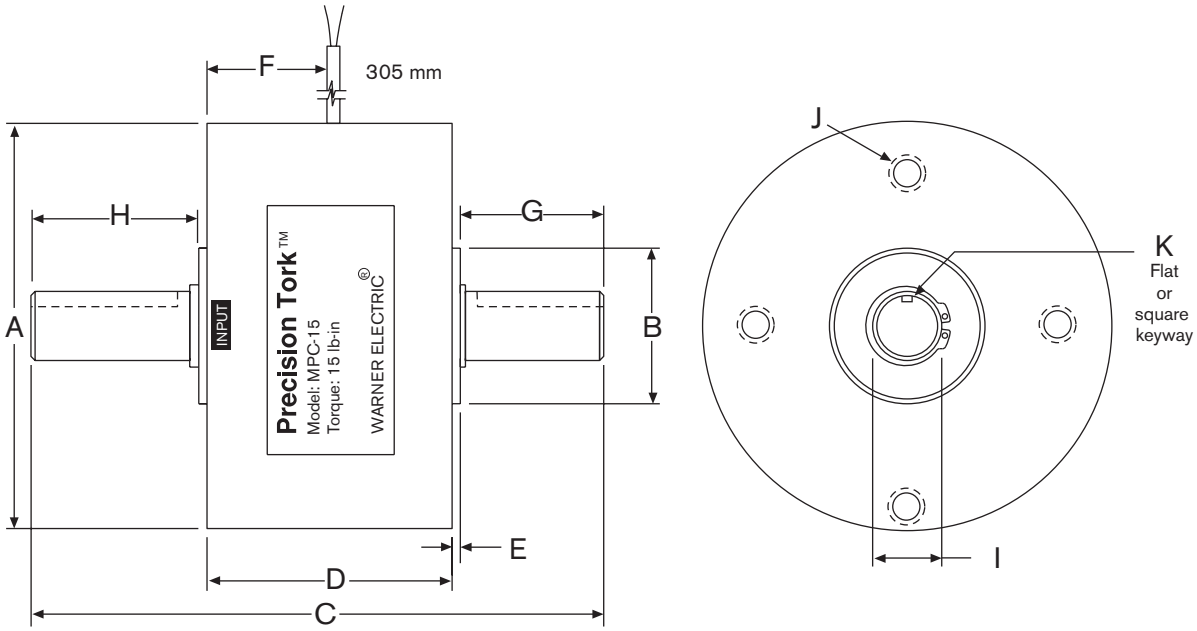
$= 500 - 125$
$= 375$ RPM

Thermal Energy $= 0{,}103 \cdot \text{Torque} \cdot \text{slip}$
$= 0{,}103 \cdot 2{,}53 \cdot 375$
$= 97{,}72$ watts

Select a clutch that exceeds the maximum torque and thermal energy requirements from the Quick Selection Chart – **MPC120**.

* To maximize tension control and minimize heat generated, select a drive system that will result in an actual input speed as close to, but not less than, 30 RPM greater than the core RPM. In this example, 358 + 30 = 388, would be ideal but 500 RPM was more readily available.

Magnetic particle clutches

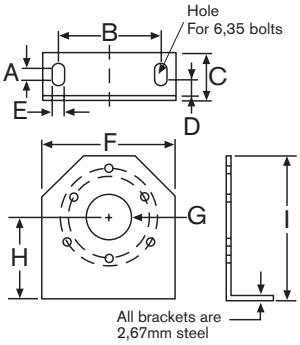


Dimensions and specifications

Models	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (output) (Inch)	H (input) (Inch)	I (Inch)	J (Number) (Inch)	K (Inch)	min. 15 pcs
MPC2	53,59	19,05/19,02	97,03	47,24	1,52	28,96	0,88	0,88	0,2497/0,2492	(3) #6-32 on 1.350 BC	Flat	Metric shafts on request
MPC15	75,18	28,57/28,55	122,17	71,12	1,78	42,42	1,00	1,00	0,4997/0,4992	(3) #8-32 on 2.000 BC	Flat	
MPC70	113,79	41,27/41,25	166,37	93,22	2,54	52,83	1,35	1,35	0,7497/0,7492	(4) #10-32 on 4.228 BC	0,188 Keyway	
MPC120	133,35	41,27/41,25	178,31	101,6	2,54	60,96	1,50	1,35	0,7497/0,7492	(4) #1/4-20 on 4.812 BC	0,188 Keyway	

Models	Drag torque (Nm)	Rated torque (Nm)	Rated voltage (V)	Resistance (Ω)	Rated current (A)	Response zero force (ms)	Response with force (ms)	Inertia of output shaft (kgcm²)	Max. heat dissipation (W)	Max. speed (RPM)	Weight (kg)
MPC2	0,044	0,22	24	92	0,261	8	4	0,0039	10	1800	0,454
	0,044	0,22	90	1552	0,058	8	4	0,0039	10	1800	0,454
MPC15	0,044	1,65	24	80	0,302	25	9	0,043	20	1000	2,72
	0,044	1,65	90	1501	0,06	25	9	0,043	20	1000	2,72
MPC70	0,11	7,9	24	35	0,677	70	17	0,26	100	1000	7,71
	0,11	7,9	90	613	0,147	70	17	0,26	100	1000	7,71
MPC120	0,22	13,5	24	33	0,742	90	25	1,1	140	1000	9,98
	0,22	13,5	90	475	0,19	90	25	1,1	140	1000	9,98

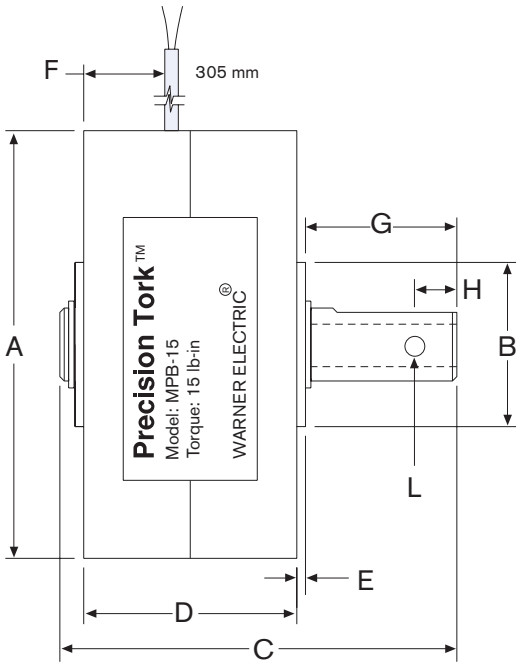
Optional Mounting Bracket (for mounting MPB Brakes and MPC Clutches)

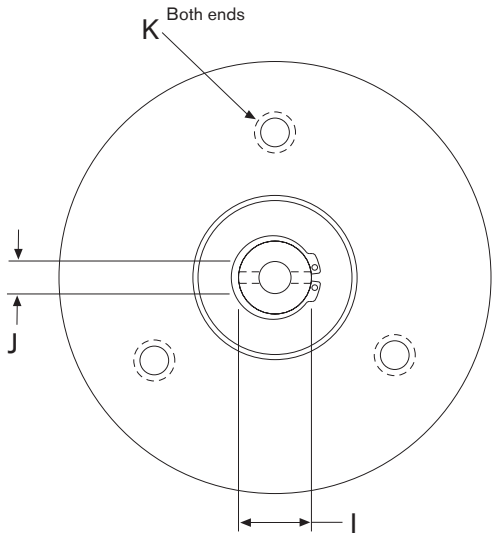


Models	Size	A	B	C	D	E	F	G	H	I
MPB-2B	2	6,9	44,5	29,3	9,9	7,1	63,5	19,1	38,1	76,2
MPB-15B	7, 15, 35	6,9	63,5	29,3	9,9	7,1	88,9	28,6	50,8	101,6
MPB-70B	70	6,9	123,8	29,3	9,9	7,1	152,4	41,3	88,9	152,4
MPB-120B	120	6,9	123,8	29,3	9,9	7,1	152,4	41,3	88,9	158,8
MPB-240B	240	6,9	123,8	29,3	9,9	7,1	165,1	62,0	101,6	190,5

Dimensions in mm

Magnetic particle brakes





Dimensions and specifications

Models	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (Inch)	H Inch	I (shaft) Inch	J (bore) Inch	L Inch	K (Number) Inch	min. 15 pcs
MPB2-1	53,59	19,05/19,02	56,64	29,21	1,52	18,29	0,88	–	0,2947/0,2492	Solid shaft	1 FLAT	(3) #6-32 on 1.350 BC	Metric shafts or bores on request
MPB15-1	74,42	28,57/28,55	77,47	37,08	1,78	21,84	1,35	–	0,3747/0,4992	Solid shaft	1 FLAT	(3) #8-32 on 2000 BC	
MPB15-2	74,42	28,57/28,55	52,07	37,08	1,78	21,84	0,35	0,18	0,499	0,375/0,376	Bore 0,125	(3) #6-32 on 1.350 BC	
MPB15-3	74,42	28,57/28,55	68,58	37,08	1,78	21,84	1,00	–	0,4997/0,4992	Solid shaft	1 FLAT	(3) #6-32 on 1.350 BC	
MPB70-1	113,79	41,27/41,25	66,55	44,7	2,54	24,89	0,50	0,18	0,749	0,500/0,501	Bore 0,125	(4) #10-32 on 4.228 BC	
MPB70-2	113,79	41,27/41,25	85,6	44,7	2,54	24,89	1,25	–	0,7497/0,7492	Solid shaft	Keyway 0,188	(4) #10-32 on 4.228 BC	
MPB120-1	133,35	41,27/41,25	102,11	55,12	2,54	29,97	1,50	0,50	0,749	0,500/0,501	Bore 0,156	(4) #1/4-20 on 4.812 BC	
MPB120-2	133,35	41,27/41,25	102,11	55,12	2,54	29,97	1,50	–	0,7497/0,7492	Solid shaft	Keyway 0,188	(4) #1/4-20 on 4.812 BC	
MPB240-1	157,73	62/61,98	118,36	67,31	2,54	37,08	1,65	–	0,7497/0,7492	Solid shaft	Keyway 0,188	(4) #1/4-20 on 5.875 BC	
MPB240-2	157,73	62/61,98	89,15	67,31	2,54	37,08	0,50	–	1,377	0,875/0,876	Keyway 0,188	(4) #1/4-20 on 5.875 BC	
MPB240-3	157,73	62/61,98	89,15	67,31	2,54	37,08	0,50	–	1,377	1,000/1,001	Shallow key. 0,250	(4) #1/4-20 on 5.875 BC	

Models	Drag torque (Nm)	Rated torque (Nm)	Rated voltage (V)	Resistance (Ω)	Rated current (A)	Response zero force (ms)	Response with force (ms)	Inertia of output shaft (kgcm²)	Max. heat dissipation (W)	Max.. speed (RPM)	Weight (kg)
MPB2	0,044	0,22	24	92	0,261	8	4	0,0037	10	1800	0,45
	0,044	0,22	90	1552	0,058	8	4	0,0037	10	1800	0,45
MPB15	0,044	1,69	24	80	0,302	25	9	0,04	20	1000	1,36
	0,044	1,69	90	1501	0,06	25	9	0,04	20	1000	1,36
MPB70	0,11	7,9	24	35	0,677	70	17	0,23	100	1000	3,2
	0,11	7,9	90	613	0,147	70	17	0,23	100	1000	3,2
MPB120	0,22	13,5	24	33	0,742	90	25	1,09	140	1000	5,45
	0,22	13,5	90	475	0,19	90	25	1,09	140	1000	5,45
MPB240	0,44	27,1	24	19	1,286	150	45	3,92	200	1000	9,1
	0,44	27,1	90	246	0,366	150	45	3,92	200	1000	9,1

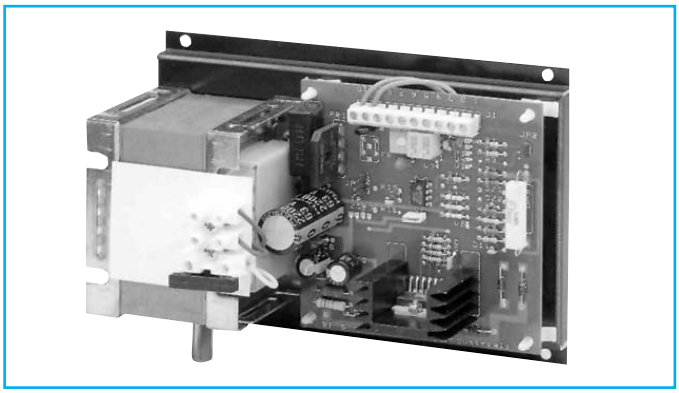
*Minimum speed = 30 RPM

Current regulator power supply for powder brakes

The TCS250 card was designed especially for controling powder brakes and for increasing their yield. In fact, this permits complete elimination of residual magnetism in the powder and therefore it is possible to work in low torque ranges without limits.

The components used are professional type and this assures absolute reliability over time. Its limited size facilitates wall mounting.

Connection is easy and is done via 10-pole connector fastened to the terminals with screws.

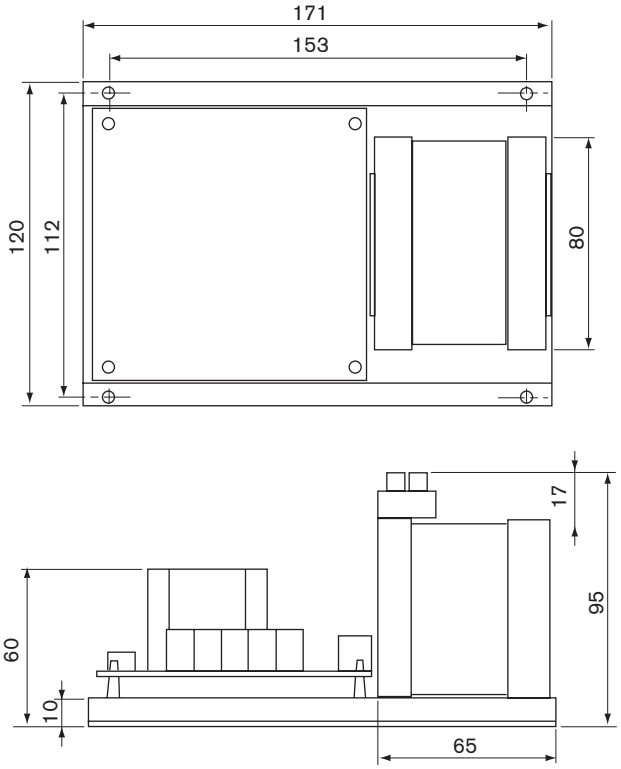


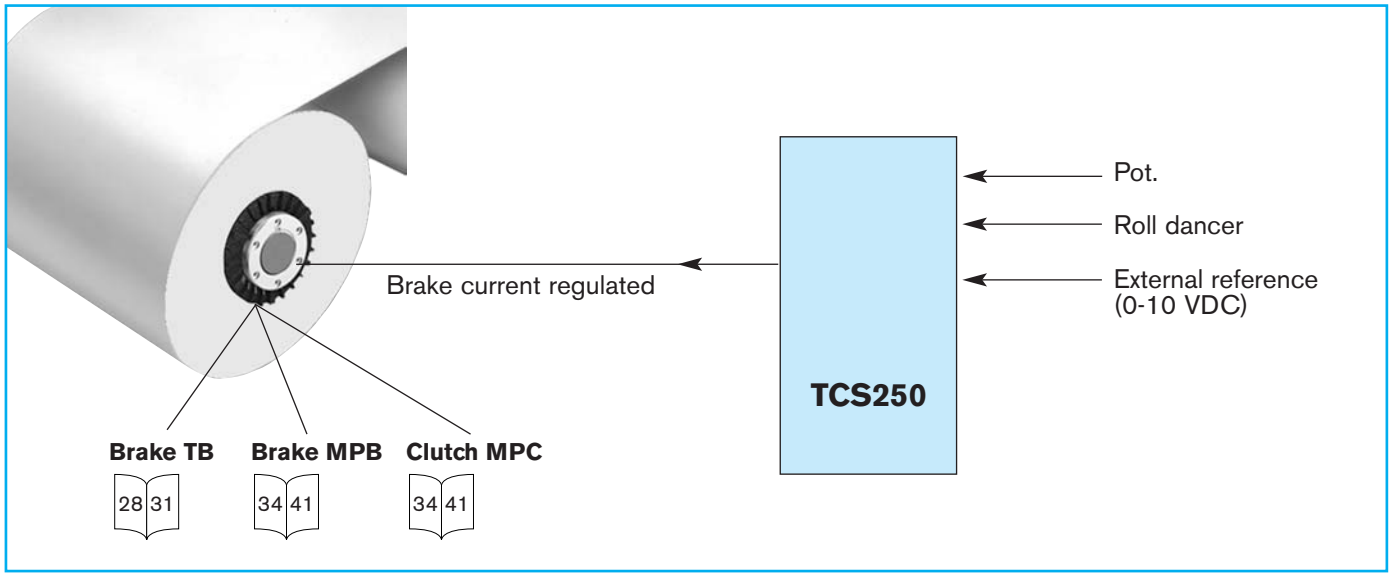
Specifications

Power supply TCS250-C	24 VAC or 24 VDC
Power supply TCS250-T	110/230VAC 50/60 Hz
Input	0-10VDC from Pot. 10K
Output	0-2A modulated PWM
Absorbed power	30 W max.
Sensibility	10 mV
Repeatability	1%
Current limiter	from -50% to +50%
Polarization	from 0 to 100%
Operating temperature	+50° max
Size	171 x 120 x 95 mm
Weight	1,500 kg

TCS250-T	Card with transformer
TCS250-C	Only card
B90-26325C	Potentiometer
Service manual	MC544

Dimensions (mm)





Magnetic clutches and brakes

Precision Tork™ units provide constant torque independent of slip speed. They offer excellent overload and jam protection for all drive train components and also provide soft starts with zero slip when a preset torque is reached. Precision Tork permanent magnet clutches and brakes do not require maintenance and provide extremely long life.

Features and Benefits

Fast, precise torque adjustment

- ❒ Torque is set with a large knurled adjustment ring
- ❒ Infinite adjustability between minimum and maximum settings. This allows units to be fine tuned to your unique requirement.

Torque is constant with respect to speed

- ❒ By using the Precision Tork™ unit, you can solve almost any torque control problem
- ❒ Torque is extremely consistent and smooth at low, as well as high speeds

No external control or power source

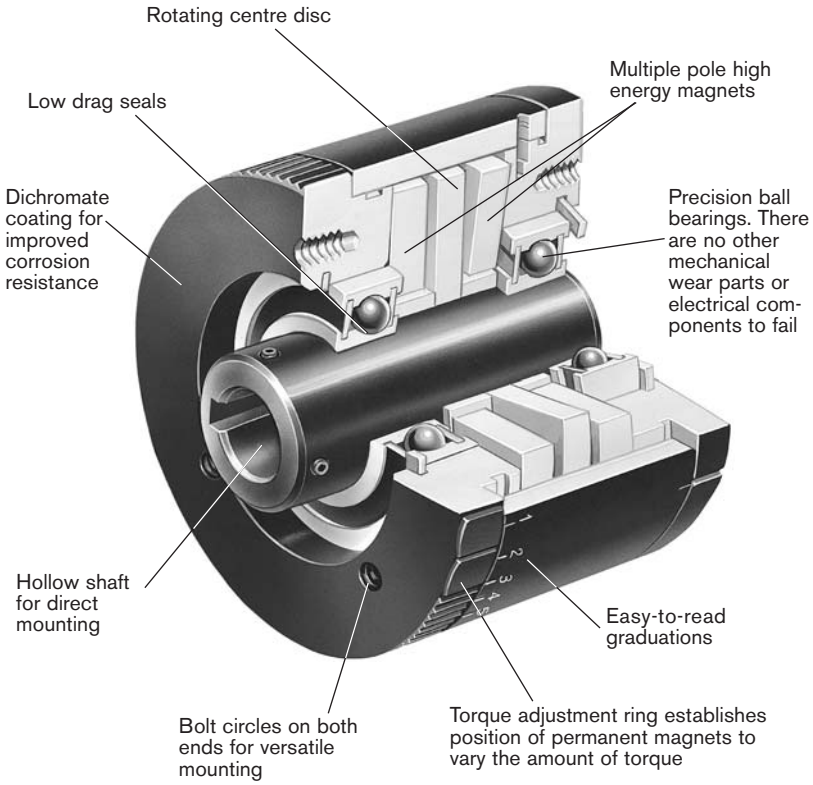
- ❒ Simple to install
- ❒ Nothing to monitor
- ❒ Unaffected by power interruption or power fluctuation
- ❒ Safe to use

Dependable performance

- ❒ Smallest possible transition from static to dynamic torque
- ❒ Virtually eliminates the “stick-slip” phenomenon associated with friction devices
- ❒ Long life. The only wearing parts are the ball bearings
- ❒ Extremely accurate. Precision Tork™ units out-perform all other devices at low RPM

Versatile mounting: Easy to retrofit

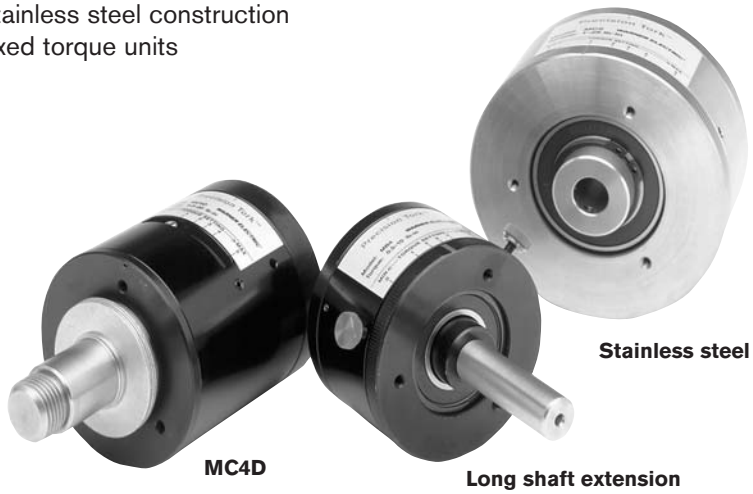
- ❒ Clutches are available with hollow bores for mounting on motor shafts or jack shafts
- ❒ Bolt circles allow for fixed mounting, adding a pulley, or stub shaft adapters
- ❒ Brakes are available with solid shaft outputs



SPECIAL APPLICATIONS

Specials are our business. . .

- ❒ Special shaft bores and keyways
- ❒ Shaft extensions
- ❒ System retrofits
- ❒ Metric bores and keyways
- ❒ Stainless steel construction
- ❒ Fixed torque units



Stainless steel

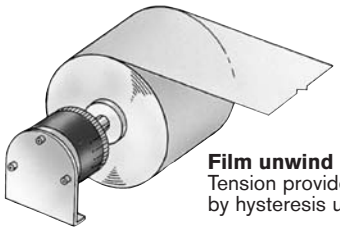
MC4D

Long shaft extension

Applications

Unwind tension control

Brake mounted on shaft of unwinds spool or bobbin



Film unwind
Tension provided by hysteresis units

Information required:
Full roll ø (m) = 0,15
ø core (m) = 0,1
Average tension (N) = 18
Velocity (m/mn) = 30

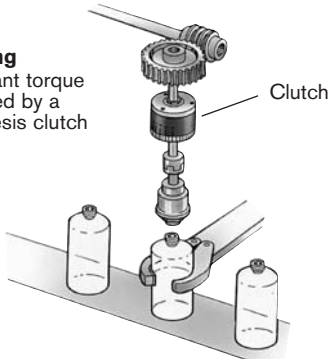
How to size:
Average radius = (Full roll ø + core ø) / 4 = (0,15 + 0,1) / 4 = 0,06 m

Average tension (Nm) =
Average tension · Average radius = 18 · 0,06 = 1,08 Nm

Check tension range:
Max. tension =
Torque · 2 / core ø =
1,08 · 2 / 0,1 = 21,6 N
Min. tension =
Torque · 2 / full roll ø =
1,08 · 2 / 0,15 = 14,4 N
Slip watts (watt) =
(Max. tension · velocity) / 60 =
(21,6 · 30) / 60 = 10,8 watts

Select **MC4 Model**

Cycling application



Bottle capping
Constant torque provided by a hysteresis clutch

Information required:
Slip = 500 tr/mn
Torque = 0,90 Nm
% slip time of total cycle time = 25%

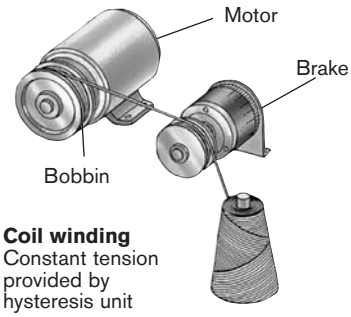
Select an **MC4 Model** from the specification chart.

* Consult factory if peak slip watts are extremely high or if duration of slip period is in excess of 1 minute

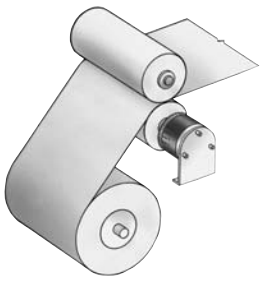
How to size:

$$*\text{Watts} = \frac{\text{Torque} \cdot \text{slip}}{9{,}55} \cdot 0{,}25 = \frac{500 \cdot 0{,}9}{9{,}55} \cdot 0{,}25 = 11{,}8 \text{ watts}$$

Nip roll or pulley tension control



Coil winding
Constant tension provided by hysteresis unit



Film tensioning
Constant tensioning supplied by hysteresis unit

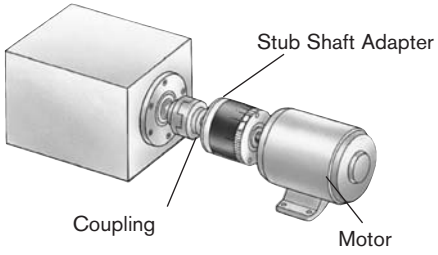
Information required:
Pulley or nip roll diameter = 0,1 m
Tension = 26 N
Velocity = 30 m/mn

How to size:
Torque = Tension · ø / 2 = 26 · 0,1 / 2 = 1,3 Nm
Slip watts = (max. tension · velocity) / 60
= (26 · 30) / 60 = 13 watts

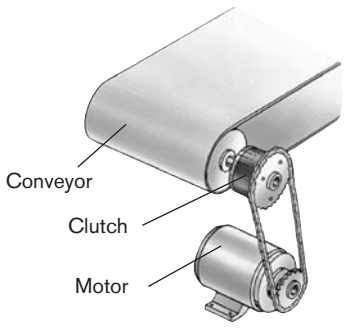
Select **MC5 Model**

Overload protection / Torque limiting / Soft start

Motor horsepower method



Torque limiting
Hysteresis clutch provides overload protection



Material handling
Hysteresis clutch can provide overload protection and soft start

Information required:
Power motor = 0,37 kw
Speed motor = 1750 RPM

How to size:
Torque = 9550 · kw / N =
9550 · 0,37 / 1750 = 2 Nm

Select an **MC5 Model** from the specification chart.

Magnetic clutches and brakes

Clutch

Brake

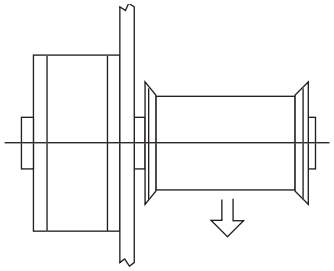
Specifications

CLUTCHES								
Models	**Torque**	**Dissipation (Watts)**	**Inertia (kgm^2)**	**Bending moment (Nm)**	**Speed (RPM)**	**Weight (kg)**	**Standard bores (Inch)**	**min. 15 pcs (mm)**
MC1.5	0,071 - 0,71 Ncm	10	4,9 x 10-6	0,56	3600	0,31	1/4	Metric bores on request
MC2	0,071- 1,58 Ncm	10	4,9 x 10-6	0,56	3600	0,31	1/4	
MC3	0,033 - 0,68 Nm	18	4,6 x 10-5	1,1	1800	0,9	3/8	
MC4	0,056 - 1,24 Nm	22	9,4 x 10-5	1,1	1800	1,13	3/8,1/2,5/8	
MC5	0,11 - 3,4 Nm	72	5,4 x 10-4	2,82	1800	4,08	3/8, 1/2, 5/8, 3/4, 7/8, 1	
MC5.5	0,11 - 5,6 Nm	110	8,5 x 10-4	2,82	1800	4,99	5/8, 3/4, 7/8, 1	
MC6	0,22 - 7,9 Nm	150	1,4 x 10-3	2,82	1800	5,44	5/8, 3/4, 7/8, 1	
MC9	1,69 - 33,8 Nm	345	4,2 x 10-3	5,65	1200	20,41	5/8, 3/4, 7/8, 1, 1-1/8, 1-1/4	

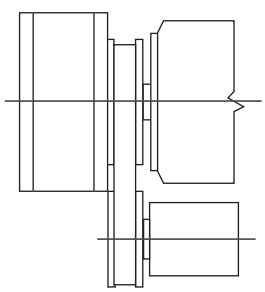
BRAKES								
Models	**Torque**	**Dissipation (Watts)**	**Inertia (kgm^2)**	**Bending moment (Nm)**	**Speed* (RPM)**	**Weight (kg)**	**Standard bores (Inch)**	**min. 15 pcs (mm)**
MB1	0 - 0,078 Ncm	3	2,5 x 10-7	0,11	3600	0,057	3/16	Metric shafts on request
MB1.5	0,071 - 0,71 Ncm	10	6,3 x 10-6	0,56	3600	0,31	1/4	
MB2	0,071 - 1,58 Ncm	10	6,3 x 10-6	0,56	3600	0,31	1/4	
MB3	0,033 - 0,68 Nm	18	4,9 x 10-5	1,13	1800	0,9	3/8	
MB4	0,055 - 1,24 Nm	22	9,7 x 10-5	1,13	1800	1,13	5/8	
MB5	0,11 - 3,4 Nm	72	5,8 x 10-4	2,82	1800	4,08	1	
MB5.5	0,11 - 5,6 Nm	110	8,8 x 10-4	2,82	1800	4,99	1	
MB6	0,22 - 7,9 Nm	150	1,4 x 10-3	2,82	1800	5,44	1	
MB9	1,69 - 33,8 Nm	345	4,2 x 10-3	5,65	1200	20,41	1	

*Minimum speed = 2 RPM

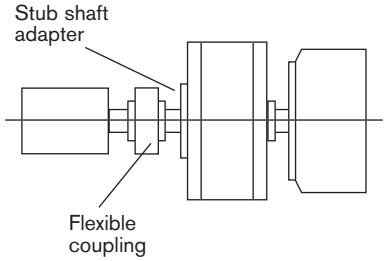
Typical mounting



Brake
Typical setup for tensioning wire, film and fibers

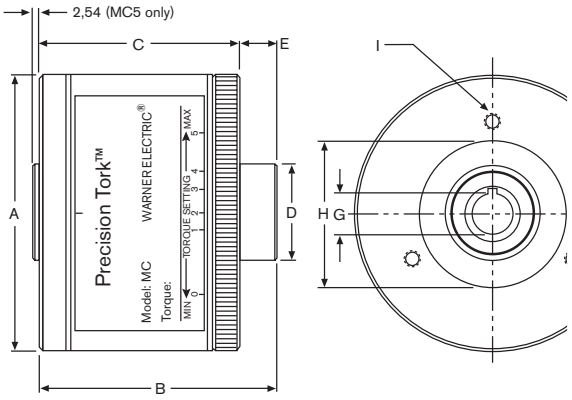


Clutch
Typical setup for material handling, soft starts and torque limiting



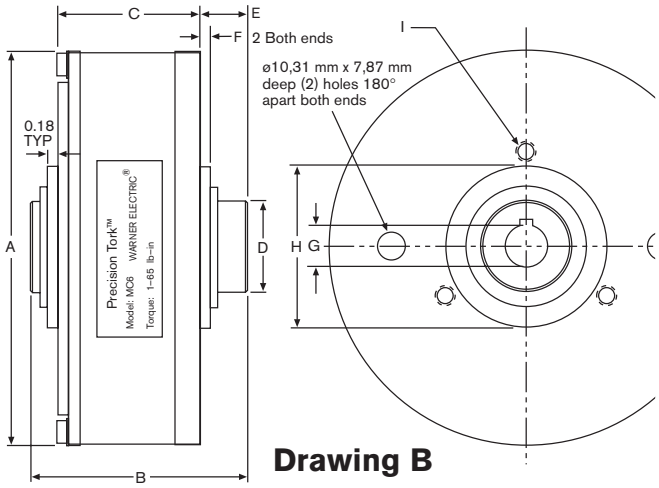
Clutch Coupling
Typical setup for torque limiting protection used for labeling, capping and printing applications

Magnetic clutches



Drawing A

*Set screw adjustment



Drawing B

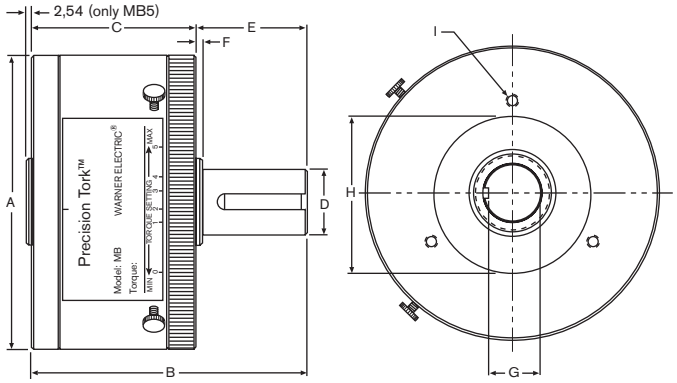
*Spanner wrench adjustment

Models	Drawing	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
MC1.5	A	46,99	40,89	34,29	9,525	6,6	–
MC2	A	46,99	40,89	34,29	9,525	6,6	–
MC3	A	69,85	56,89	50,8	14,99	6,1	–
MC4	A	82,04	57,4	50,8	24,99	6,6	–
MC5	A	118,11	80,77	67,31	35	10,67	–
MC5.5	A	134,37	82,55	67,31	35	15,24	–
MC6	B	154,94	80,77	51,816	35	18,54	4,57
MC9	B	238,76	105,92	88,65	44,96	13,97	3,3

Bore & Keyseat Sizes

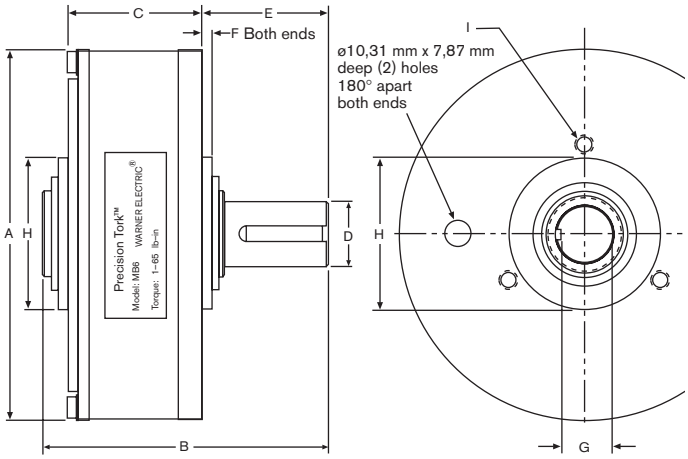
Models	"G" Bore (Inch)	Keyway (Inch)	Metric bore and key min. 50 pcs	"H" centring diameter x deep in mm (both side)	"I" bore (Inch)	Setting locking
MC1.5	1/4	Without	On request	22.225/22.20 x 2	3) 6-32 x 5/16 dp 1.25 B.C.	Pin 3/32
MC2	1/4	Without	On request	22.225/22.20 x 2	3) 6-32 x 5/16 dp 1.25 B.C.	Pin 3/32
MC3	3/8	Without	On request	35.13/35.08 x 3.05	3) 10-32 x 7/16 dp 1.875 B.C.	Set screws
MC4	3/8	Without	On request	46.99/46.965 x 2	3) 10-32 x 7/16 dp 2.375 B.C.	Set screws
	1/2	1/8	On request			Set screws
	5/8	3/16	On request			Set screws
MC5	3/8	Without	On request	62/61.97 x 2.54	3) 10-32 x 1/2 dp 3.00 B.C.	Set screws
	1/2	1/8	On request			Set screws
	5/8	3/16	On request			Set screws
	3/4	3/16	On request			Set screws
	7/8	3/16	On request			Set screws
	1	1/4 Shallow key	On request			Set screws
MC5.5	5/8	3/16	On request	62/61.97 x 2.54	3) 10-32 x 1/2 dp 3.00 B.C.	Set screws
	3/4	3/16	On request			Set screws
	7/8	3/16	On request			Set screws
	1	1/4 Shallow key	On request			Set screws
MC6	5/8	3/16	On request	62/61.97	3) 1/4-20 x 5/16 dp 2.875 B.C.	Set screws
	3/4	3/16	On request			Set screws
	7/8	3/16	On request			Set screws
	1	1/4 Shallow key	On request			Set screws
MC9	5/8	3/16	On request	82.55/82.5	4) 5/16-18 x 1/2 dp 5.875 B.C.	Set screws
	3/4	3/16	On request			Set screws
	7/8	3/16	On request			Set screws
	1	1/4	On request			Set screws
	1-1/8	1/4	On request			Set screws
	1-1/4	1/4	On request			Set screws

Magnetic brakes



*Set screw adjustment

Drawing C



*Spanner wrench adjustment

Drawing D

Models	Drawing	A (mm)	B (mm)	C (mm)	D shaft (Inch)	D shaft (mm)	E (mm)	F (mm)	G (Inch)	"H" Centring diameter x deep in mm (both side)	"I" Bores (Inch)
MB1	C	25,4	35,31	21,59	3/16		14,73	-	0.170 Plat	7,645/7,68 x 2,54	3) 4-40 x 1/4 dp 0.610 B.C
MB1.5	C	46,99	59,69	34,29	1/4	On request	25,4	-	0.230 Plat	22,225/22,20 x 2	3) 6-32 x 5/16 dp 1.250 B.C
MB2	C	46,99	59,69	34,29	1/4	min. 15 pcs	25,4	-	0.230 Plat	22,225/22,20 x 2	3) 6-32 x 5/16 dp 1.250 B.C
MB3	C	69,85	76,71	50,8	3/8		26,16	0,76	0.350 Plat	35,13/35,08 x 3,05	3) 10-32 x 7/16 dp 1.875 B.C
MB4	C	82,04	75,44	50,8	5/8		24,64	2,29	0.518/0.503	46,99/46,965 x 2	3) 10-32 x 7/16 dp 2.375 B.C
MB5	C	118,11	111,76	67,31	1		44,45	2,79	0.859/0.844	62/61,97 x 2,54	3) 10-32 x 1/2 dp 3.000 B.C
MB5.5	C	134,37	115,06	67,31	1		47,75	6,35	0.859/0.844	62/61,97 x 2,54	3) 10-32 x 1/2 dp 3.000 B.C
MB6	D	154,94	114,3	51,82	1		56,39	4,57	0.859/0.844	62/61,97	3) 1/4-20 x 5/16 dp 2.875 B.C
MB9	D	238,76	137,41	88,65	1		45,72	3,3	0.859/0.844	82,55/82,5	3) 5/16-18 x 1/2 dp 5.875 B.C

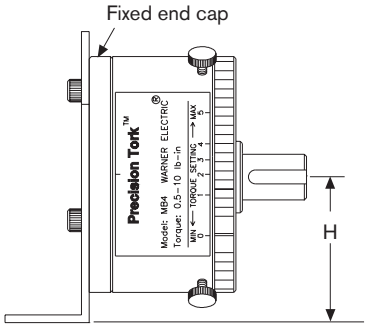
Option :

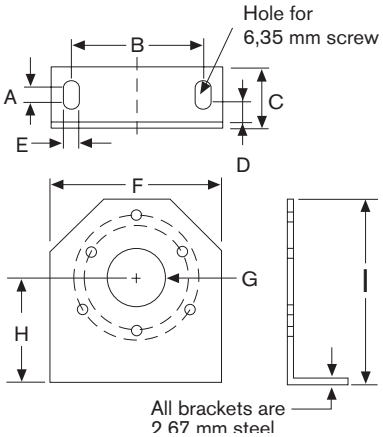
Mounting Bracket

Note : Mount bracket to fixed end cap – side opposite knurled adjustment ring.

Models	Size	A	B	C	D	E	F	G	H	I
MPB-2B	MB2 MC2	6,9	44,5	29,3	9,9	7,1	63,5	19,1	38,1	76,2
MPB-15B	MB3/MC3 MB4/MC4	6,9	63,5	29,3	9,9	7,1	88,9	28,6	50,8	101,6
MPB-70B	MB5 MC5	6,9	123,8	29,3	9,9	7,1	152,4	41,3	88,9	152,4
MPB-120B	MB5.5 MC5.5	6,9	123,8	29,3	9,9	7,1	152,4	41,3	88,9	158,8
MPB-240B	MB6 MC6	6,9	123,8	29,3	9,9	7,1	165,1	62,0	101,6	190,5

Dimensions in mm





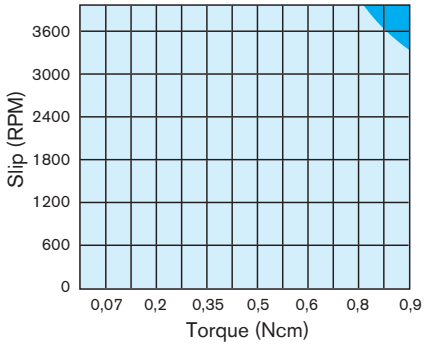
Magnetic clutches and brakes

Heat Dissipation Charts

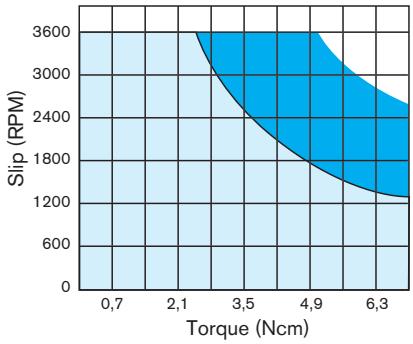
Intermittent operation (50 & duty cycle)

Continuous operation

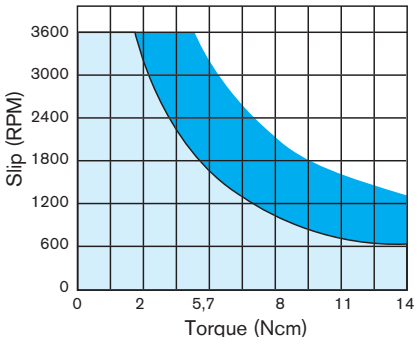
MB1



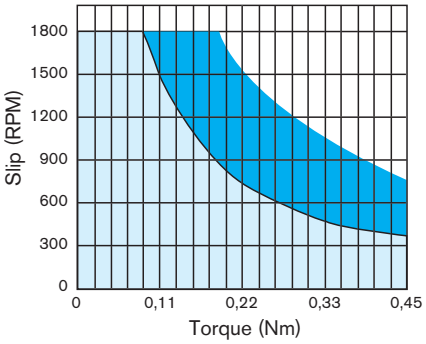
MC1.5/MB1.5



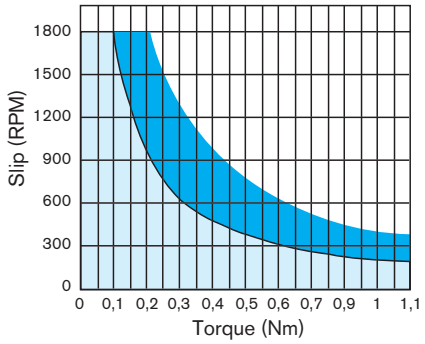
MC2/MB2



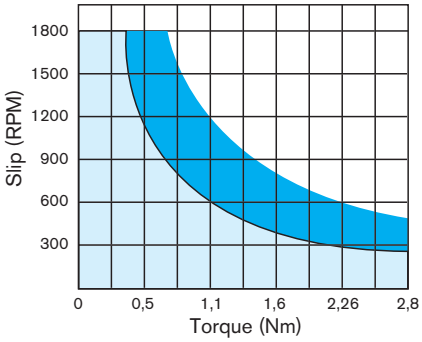
MC3/MB3



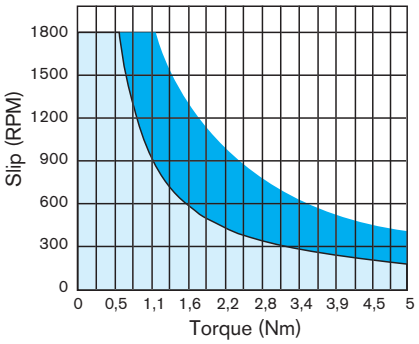
MC4/MB4



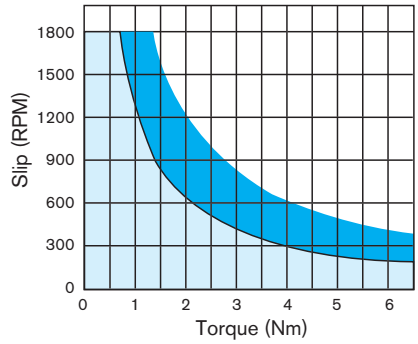
MC5/MB5



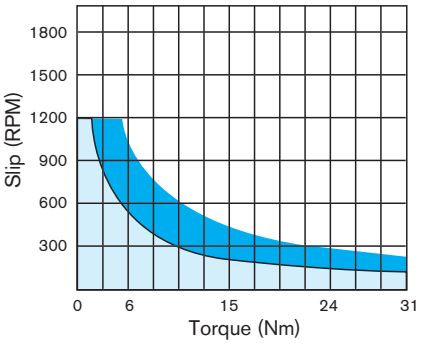
MC5.5/MB5.5



MC6/MB6

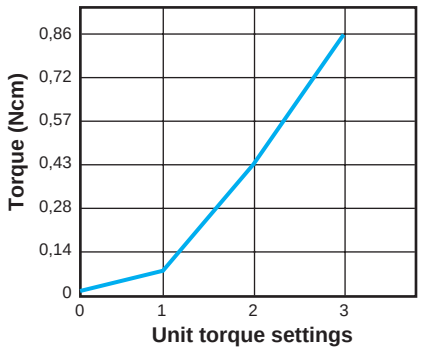


MC9/MB9

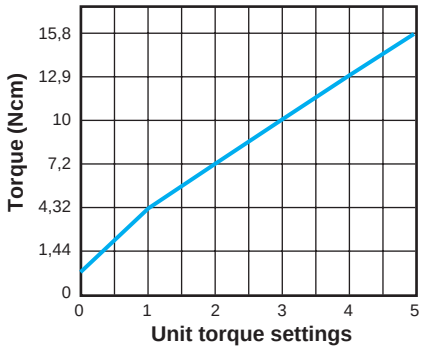


Torque Setting Charts

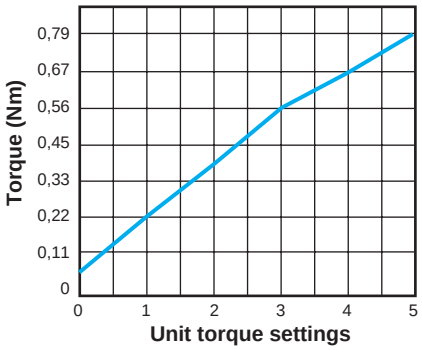
MB1



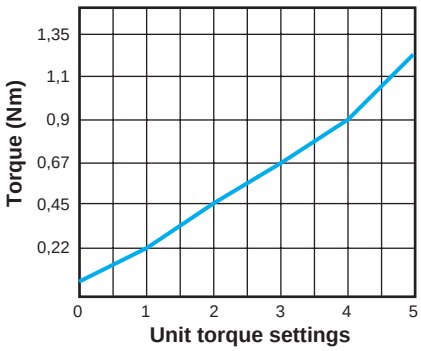
MC2/MB2



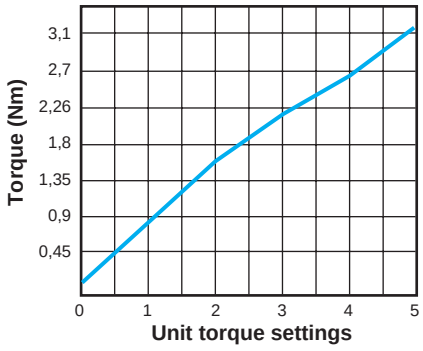
MC3/MB3



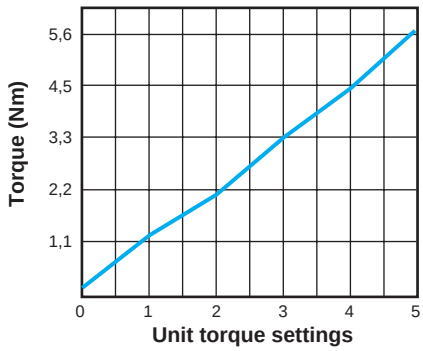
MC4/MB4



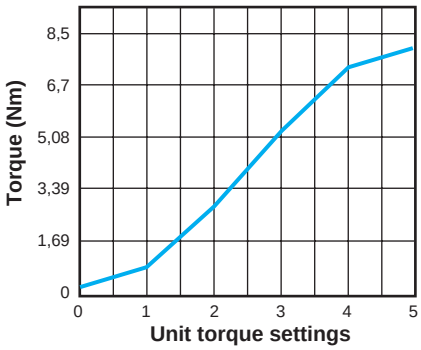
MC5/MB5



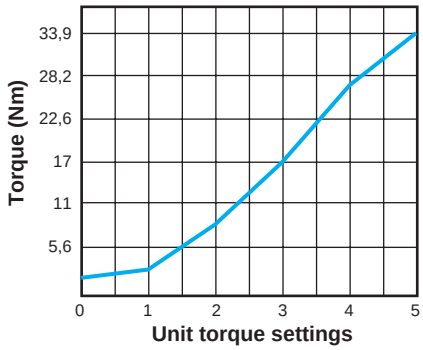
MC5.5/MB5.5



MC6/MB6

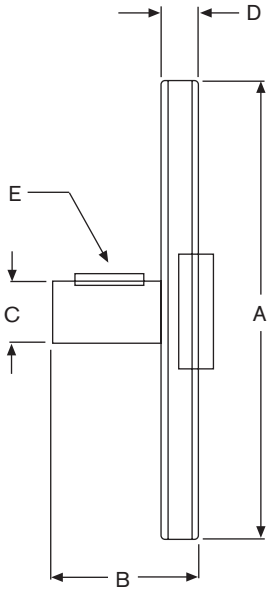


MC9/MB9



Stub shaft adapters

- ❒ Utilized when "clutch coupling" configuration is desired
- ❒ Comes complete with attachment hardware and drive key
- ❒ Stub shaft adapters should be used in conjunction with a flexible coupling



Size	Models	A (mm)	B (mm)	C* (Inch)	D (mm)	E
A2-14	MC2	40,64	19,81	1/4	3,81	Flat
A3-38	MC3	59,94	30,23	3/8	4,83	Flat
A4-38	MC4	72,64	30,23	3/8	4,83	Flat
A4-58	MC4	72,64	30,23	5/8	4,83	Key 3/16 inch
A5-1	MC5/MC5.5	87,63	43,69	1	6,86	Key 1/4 inch
A5-12	MC5/MC5.5	87,63	37,34	1/2	6,86	Key 1/8 inch
A6-34	MC6	86,36	43,18	3/4	8,89	Key 3/16 inch

* On request units in metric size available, minimum : 15 pcs

How to Order ?

1. Torque
Determine the maximum torque that your application requires. See the application example.

2. Energy dissipation
Determine the amount of energy or heat that will be generated during operation. Each clutch or brake is rated for a specific amount of energy, given in units of watts, that it can safely dissipate.

3. Model selection
Select the clutch or brake based on torque and energy requirements. See the specifications under “Heat Dissipation and Torque Setting Charts.”

4. Select Bore Size
Select the proper bore size for the application.
On request units in metric size available, minimum : 15 pcs

5. Example

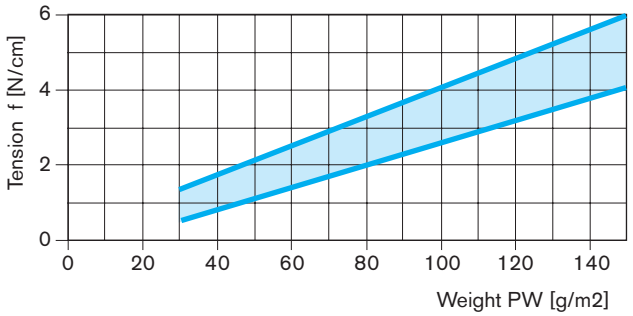
Torque Requirement = 1 Nm
Energy Requirement = 35 watts
Bore Requirement – 5/8 inch
Select Model : **MC5-58**

Tension selection

The **WARNER ELECTRIC** *experience enables us to offer a tension guide as shown below. For any special material not included in the chart below, please consult* **WARNER ELECTRIC**. *These values are usual values for information only, please check exact tension you need in your application.*

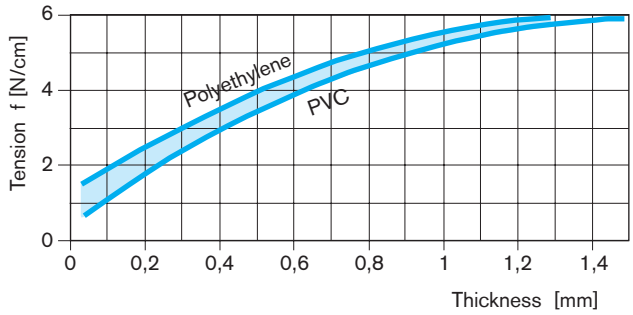
PAPER WEIGHT *

F = f x width [cm]

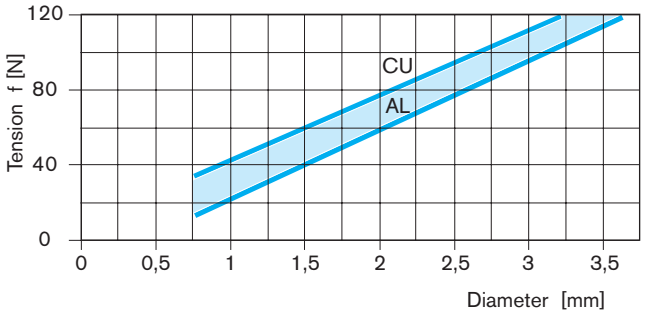


FOIL*

F = f x width [cm]



WIRE *



* Usual values for information only.

MATERIAL DENSITY

	kg/m³
Paper	920
Paper board	1420
Alu foil	2720
Alu wire	2750
Copper	8550
PVC	400-1050

Data application form

To enable us to assist you in selecting the best product type and specification to ensure reliable and accurate tension control, please submit this ***APPLICATION FORM.***

Company/Contact name:_____ Tel._____ Fax: _____

Address:_____ e mail: _____

City: _____ Country: _____ Date: _____ Business:_____

MAX. ROLL DIAMETER : _____ m MASS: _____ kg

MIN. ROLL DIAMETER : _____ m

LINE SPEED : _____ m/mn

BRAKE RATIO : _____ i = z2/z1 (Brake on roll axis i = 1)

FIRST CASE : unwind tension known

TENSION FORCE ON TOTAL WEB WIDTH : _____ N max. _____ N min.

SECOND CASE : unwind tension unknown

If unknown precise type of material :

CURRENT VALUES USED :

		PAPER		PAPER	
ALUMINIUM FOIL :	00,7 N/cm / thickness micron				
CELLOPHANE :	0,05 N/cm/ thickness micron	10 gr/m²	0,5 N/cm	130 gr/m²	3,1 N/cm
ACETATE :	0,035 N/cm / thickness micron	25 gr/m²	0,7 N/cm	150 gr/m²	3,8 N/cm
MYLAR (POLYESTER) :	0,505 N/cm / thickness micron	40 gr/m²	1 N/cm	200 gr/m²	5,5 N/cm
POLYETHYLENE :	0,017 N/cm / thickness micron	60 gr/m²	1,5 N/cm	250 gr/m²	7,7 N/cm
POLYSTIRENE :	0,06 N/cm /thickness micron	80 gr/m²	2 N/cm	330 gr/m²	11,5 N/cm
SARAN :	0,008 N/cm / thickness micron	100 gr/m²	2,5 N/cm	400 gr/m²	14,8 N/cm
VINYL :	0,01 N/cm / thickness micron				

VALUE PER CENTIMETER WIDTH : _____ N/cm / micron

NUMBER OF MICRON MATERIAL THICKNESS : _____ (Paper note 1)

TENSION FORCE BY CENTIMETER WIDTH : _____ N max. _____ N min.

ROLL WIDTH : _____ cm max. _____ cm min.

TOTAL FORCE ON ROLL WIDTH : _____ N _____ N min.

MAX. ROLL SPEED : _____ RPM

MIN. ROLL SPEED : _____ RPM

THEORIC BRAKE TORQUE : _____ Nm max. _____ Nm min.

SLIDDING TORQUE : _____ Nm

REQUIRED BRAKE TORQUE : _____ Nm max. _____ Nm min.

TOTAL HEAT DISSIPATION : _____ kW

REQUIRED BRAKE SIZE : ☐

NUMBER OF BRAKE PER ROLL : _____

REQUIRED TENSION CONTROL REGULATION : ☐

Data application form

START - STOP :

t1 = MACHINE STARTING TIME _____ secondes

t2 = ROLL ACCELERATING TIME _____ secondes

t3 = MACHINE DECCELARATING TIME _____ secondes

t4 = BRAKE ACCELARATING TIME _____ secondes

MB (see catalogue MTB-II or TB) or stopping brake applied _____ Nm

ACCELERATION TIME = t2 = m · v/120 · F _____ secondes

(force must accelerate the roll)

Storage length = l = v/120 · (t2 - t1) _____ metres

(if machine is accelerating faster : t1 < t2)

If the dancer load is a mass, _____ Newtons

the tension force will increase = F' = F · v/118 · t1

or

I the dancer load is a mass, _____ Newtons

the tension force will increase = F' = F · v/118 · t2

DECCELERATION :

1) Maintaining the web force, (warning : exact values if MB or t3 defined) :

Braking torque = MB = ((m · D · v/240 · t4) + F · D/2) · 1/i _____ Nm 0 if MB not defined

Time t4 = m · D · v/240 · (MB · i - F · D/2) _____ secondes 0 if MB not defined

Si t4 > t3 necessary lenght = l = v · (t4-t3)/120 _____ metres 0 if t3 not defined

2) Uncontrolled emergency stop :

Emergency stopping time = t = m · D · v/240 · MB · i _____ secondes

Material length spillage = l = v · t/120 _____ metres

Subject to alteration without prior notice

Zentrale

Max Lamb GmbH & Co. KG
Am Bauhof
97076 Würzburg
Telefon: 09 31 / 27 94-0
Telefax: 09 31 / 27 45 57
eMail: ant@lamb.de
Internet www.lamb.de

Niederlassungen

ASCHAFFENBURG

Schwalbenrainweg 30 a
63741 Aschaffenburg
Telefon: 0 60 21 / 34 88-0
Telefax: 0 60 21 / 34 88 32
eMail: ab@lamb.de

NÜRNBERG

Dieselstraße 18
90765 Fürth
Telefon: 09 11 / 76 67 09-0
Telefax: 09 11 / 76 67 09 22
eMail: nb@lamb.de

SCHWEINFURT

Carl-Zeiss-Straße 20
97424 Schweinfurt
Telefon: 0 97 21 / 76 59-0
Telefax: 0 97 21 / 6 99 93
eMail: sw@lamb.de

STUTTGART

Heerweg 15/A
73770 Denkendorf
Telefon: 07 11 / 93 44 83-0
Telefax: 07 11 / 93 44 83 22
eMail: st@lamb.de

LA-WA-AbWiBr-06/04